McGraw-Hill Publishing Company, Inc.

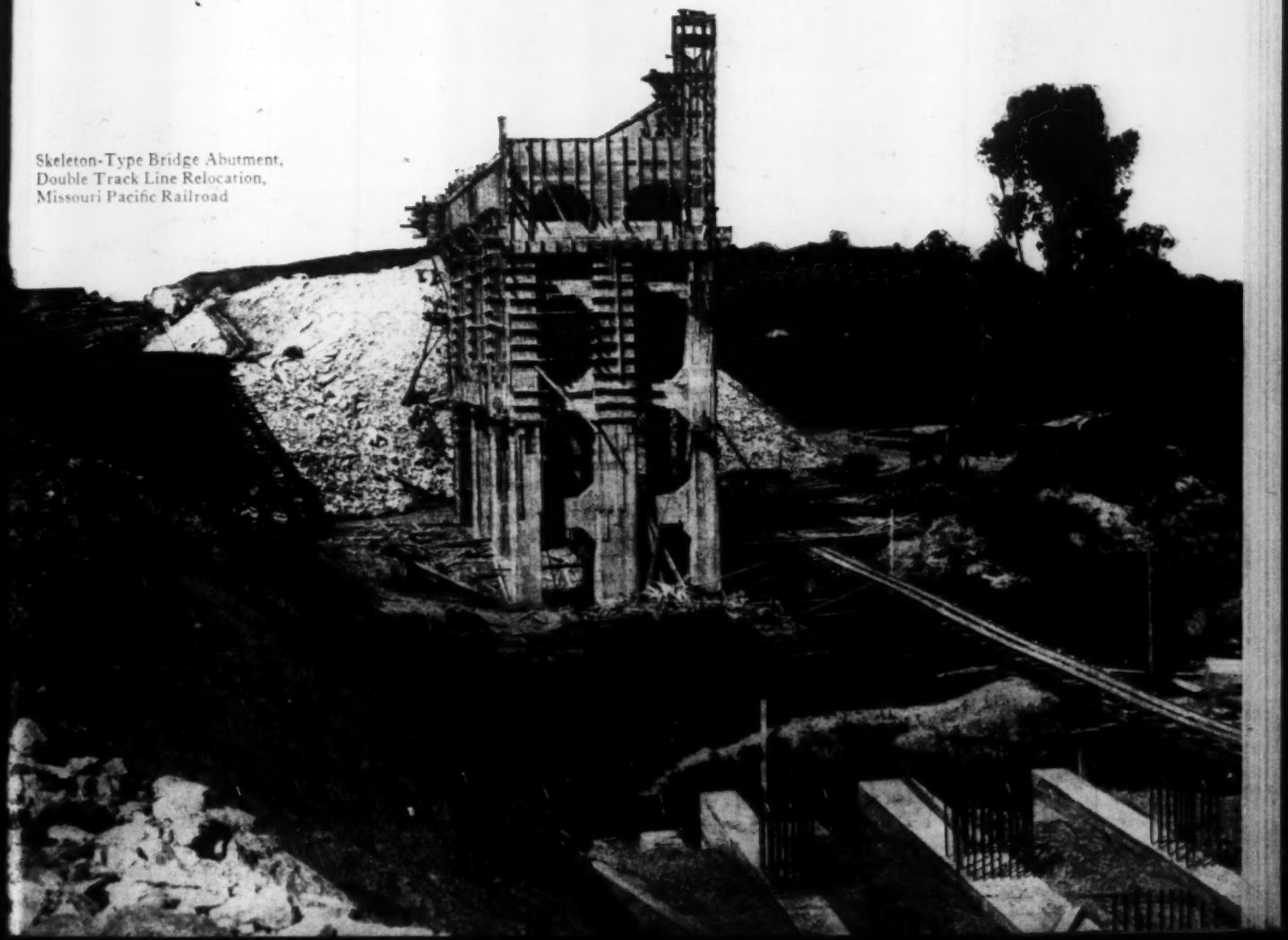
October 18, 1928

OCT - 1928

Engineering News-Record

Devoted to Civil Engineering and Contracting

Double Tracking on the Missouri Pacific Railroad
Water Meter Placing and Maintenance in New York
An Improvised Power Maintainer for Gravel Roads
Building a Rapid-Transit Viaduct at Kansas City
An Example of Modern Building Planning
Study of a Record Rainfall at Louisville, Ky.



Skeleton-Type Bridge Abutment, Double Track Line Relocation, Missouri Pacific Railroad

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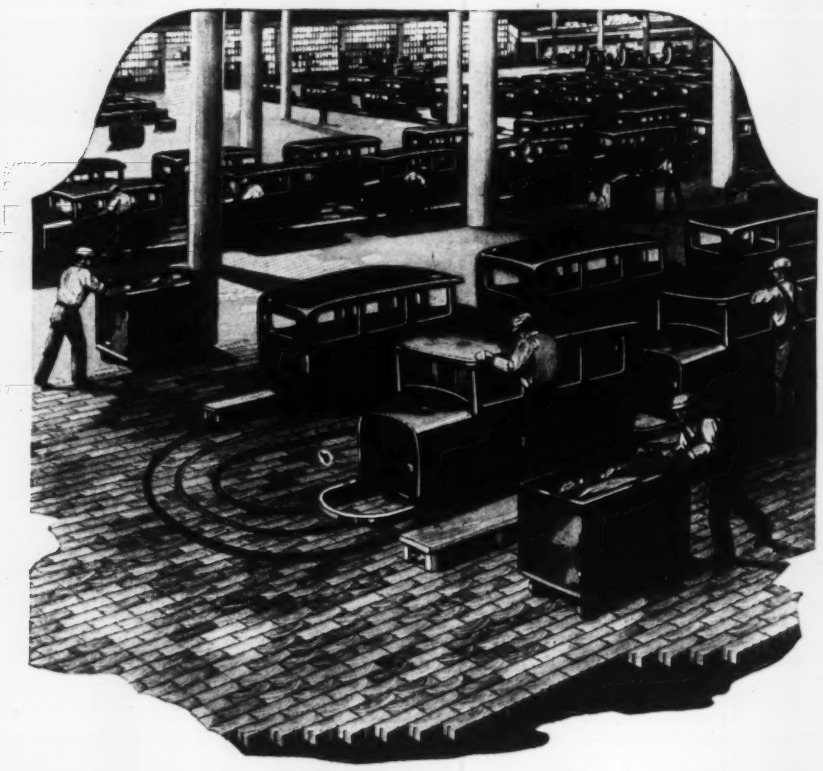

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Mississippi Flood Control
—the story to date

RECOGNIZING the extraordinary interest aroused among engineers by the unprecedented size and complexity of the flood-control prob'em in the Mississippi Valley, *Engineering News-Record* has reprinted a number of articles and related material which give a comprehensive and authoritative picture of the engineering features of the 1927 flood and of plans for control of future floods.

INCLUDED in the reprint are ten articles written by W. W. De Berard giving his observations throughout the length of the valley; abstracts of the reports of the Chief of Engineers, the Mississippi River Commission and the board of three appointed by the President to reconcile differences in the preceding two plans; also editorial comment on various phases of the undertaking.

COPIES of this 76-page booklet, which is entitled "Mississippi River Flood Control," may be obtained for 50c. each, including postage.

McGRAW-HILL PUBLISHING COMPANY, INC., TENTH AVENUE AT 36TH STREET, NEW YORK, N. Y.

NEW YORK District Office, 285 Madison Avenue
WASHINGTON, National Press Building
CHICAGO, 7 South Dearborn Street
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie Street, London, E. C. 4

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Bus Transportation — Electrical Merchandising
Electrical World — Construction Methods
Electrical West
(*Published in San Francisco*)
American Machinist—European Edition
(*Published in London*)

SUBSCRIPTION PRICES: United States and its possessions, Canada, Mexico, and other countries taking domestic postage rates, $5 a year. All other foreign countries, $9 a year. Single copy, 25 cents. Published weekly. Entered as second class matter, April 11, 1917, at the Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

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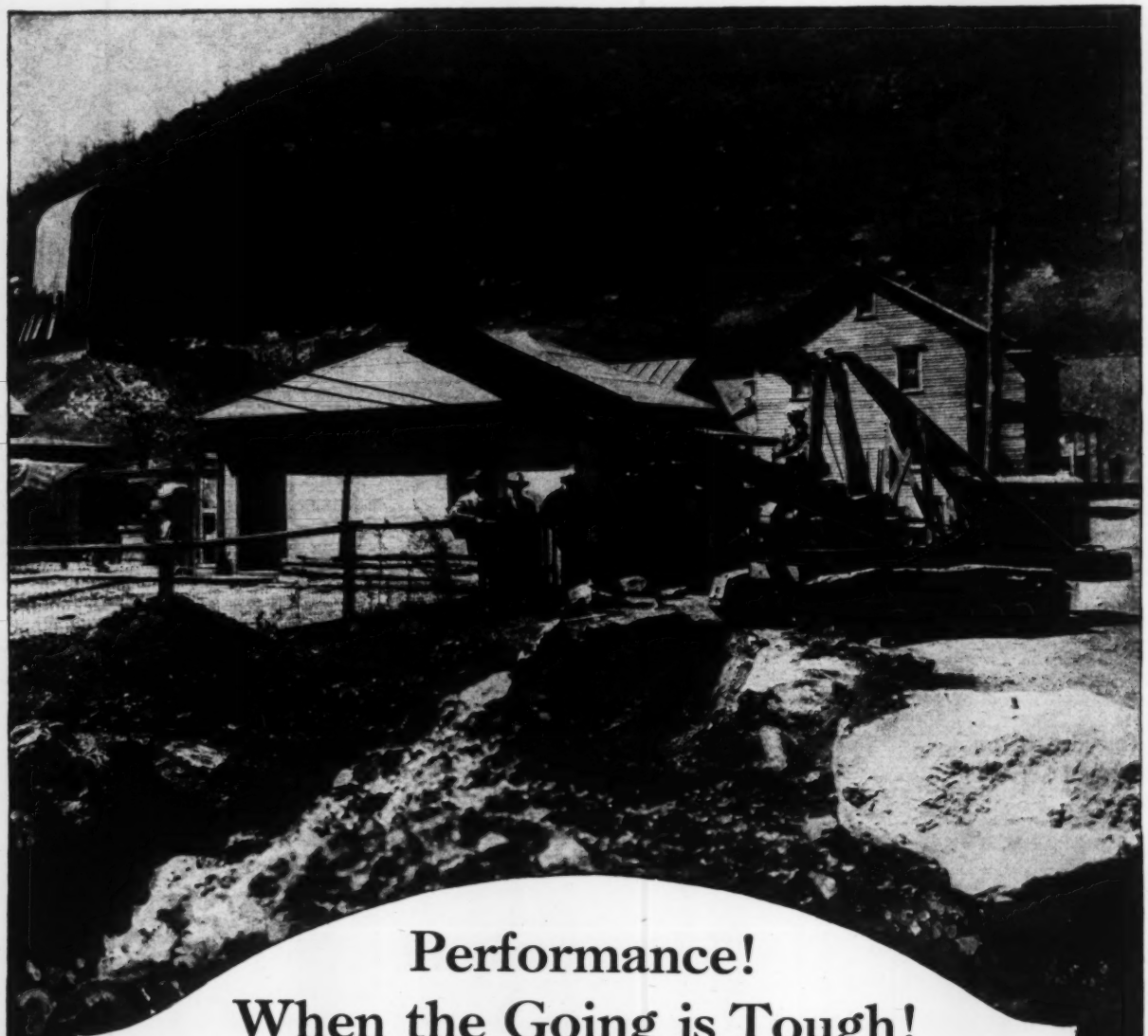
CHANGE OF ADDRESS

Subscribers are requested to send both the old address and the new address when they move to a new address.
Member—Audit Bureau of Circulations.
Member—Associated Business Papers.

Construction Market Place, 160 **Searchlight Section, 134** **Index to Advertisers, 168** **Directory of Consulting Engineers, 130**

Number of Copies Printed This Issue, 31,830



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Volume 101 NEW YORK, OCTOBER 18, 1928 Number 16

A Fair-Weather Ship

ARRIVAL of the "Graf Zeppelin" marks no new chapter in the history of transportation. It simply adds to our knowledge of the advantages and disadvantages of lighter-than-air vessels in transoceanic service. Due to its greater size and flying range, the "Zeppelin" was able to cruise around a storm which might have forced a smaller vessel to turn back. Until a lighter-than-air vessel can be built which, like the modern steamship, can leave port on its schedule knowing that it can buck any storm it may meet we can hardly look to such vessels for commercial service. Despite their great size the present-day lighter-than-air vessels are too dependent upon fair weather for a safe crossing.

Largest and Longest

ENGINEERS as a rule do not react well to descriptive superlatives. Yet few engineers deny a quickening of the pulse when a bridge surpasses all precedent. For a great bridge seems more nearly to symbolize the engineering art than the more prosaic building, dock or dam. Some such feeling is aroused by the record-breaking bridge now being built over the Detroit River. During a few short years it will be the longest suspension bridge in the world, then to be far surpassed by the Hudson River bridge at New York City. As the latter structure is taking its place in 1932 as the crowning achievement of a half-century of suspension-bridge engineering, the Kill van Kull steel arch, just begun, will relegate to yesterday the record so long held by the 1,000-ft. Hell Gate arch. With its finally determined span of 1,675 ft., the Kill van Kull bridge will be 25 ft. longer than the great arch of Sydney harbor and 40 ft. longer than the world's longest suspension bridge in 1925. Thus engineering science pushes back the borders of the impossible. Few of us will be privileged to build such structures as these, but it is no small honor to belong to the profession that they represent. Each of us basks in the reflected glory.

Reinforcing Steel in Dams

SOME problems in dam design can be worked out by experiments on models; others are susceptible of exact mathematical analysis, and still others are of a nature such that results of value can be had only after time has afforded a test. Of this latter class is the question about the effect of time on reinforcing steel in concrete dams. Despite the fact that the St. Francis failure has been attributed solely to foundations, that disaster was made the basis of an argument for putting reinforcing steel in gravity section dams. This drew fire from those who were vigorously opposed, and one eminent engineer, at least, went so far as to say that in view of the long life expected from dams, steel should not be used in any concrete dam, because it is sure to rust and disappear, damaging the concrete in so doing. This represents an extreme view, even more extreme than the suggestion of reinforcing a massive concrete dam, and if presented for general adoption would be sure to meet with vigorous protests from advocates of the various thin- and buttress-type dams. The deteriorating effect of sea water on reinforcing steel in concrete of poor quality is doubtless in some degree responsible for the apprehension about steel in dams. However, there is little ground for drawing a parallel between these two conditions of service. If it develops that some reinforced-concrete dams do not give satisfactory service because of the presence of steel, it may be necessary to keep the steel bars farther back from the surface and put over the steel a denser grade of concrete. Improved design and better construction practices may and doubtless will be developed, but it is highly improbable that reinforced-concrete dams will be declared unsafe and abandoned in favor of concrete structures containing no steel. Reinforced concrete as a type of construction has come to stay.

Cross-Connection Optimism

ALTHOUGH some may question whether the movement for the abolition of cross-connections between potable water supplies and all other sources not approved by the health departments is progressing, at a halt or receding, a reflective survey gives reason for optimism. At the Montreal convention of the New England Water Works Association it was disclosed that in place of a compromise open as to exact effect in practice, as proposed some months earlier, the committee had reached a state of disagreement, with a minority in favor of a stronger stand against cross-connections. The report was put over until a fall or winter meeting, with the understanding that whatever recommendations are finally made will be sent to letter ballot. This seems to be a case where the association should go on record on a clear-cut issue. Until the ballot is taken there is hope for a strong vote against cross-connections. The New England committee at Montreal gave as one reason for postponing action a wish to learn more about the automatic pump chlorinator, installation of which under stipulated conditions the New York State Department of Health has recently made a requisite for permitting the use of cross-connections when protected by double check valves. The conditions are severe enough to cause hesitation between using the new device and double check valves or eliminating cross-connections and have done with it. In New Jersey, after long delay in putting into full effect resolutions for abolishing cross-connections, the State Department of Health has, in effect, replaced its old resolutions in modified form by a new chapter to the state sanitary code, which perhaps gives greater stability. Although it seems to have yielded something to the opponents of elimination, it has set a date after which no new cross-connections can be made and has provided, in effect, that

after such date all cross-connections are also prohibited except for possible extensions of time for elimination, first indorsed by the local health authority; even then, a temporary extension will be granted only when the cross-connection is protected by double check valves, which, as described, must evidently be of improved Factory Mutual type. Altogether, the outlook from these three viewpoints gives reason for optimism.

Bus Franchises and Traffic

DURING the last half-dozen years a large number of franchises have been granted to operators of bus lines by public utility commissions. What the ultimate effect on other vehicular traffic may be has not always been taken into consideration. To the commonly observed nuisance of crowding private automobiles to one side of the street and producing undue wear on the pavement for which no adequate tax is paid is added a new deterrent to traffic efficiency noted in Chicago. Traffic officials in Chicago established one-way traffic on the newly paved and widened Jackson Boulevard, alternating on an in-and-out schedule morning and evening. The bus lines objected strenuously to closing the street to two-way traffic at any time, and served notice upon the authorities that their franchises entitled the buses to continuous two-way facilities. Passing out franchises for street use to street-car companies was once a function of city officials. Now state public utility commissions, often far removed from the local situation and less concerned than they should be with the necessity of modern traffic efficiency and regulation, exercise this same function. Home rule has gone into the discard and efficient street floor use and control by the local agencies becomes thereby the more difficult. It behooves franchise-giving bodies to be extremely careful in passing out privileges to the new agencies of transportation, airplanes included, if we are to attain the fullest use of our present facilities.

Airport Design—An Opportunity

UNUSUAL stress has been laid upon the civil engineer's part in the development of air transportation during the past few weeks. First, at San Diego, where a large part of the time of the quarterly meeting of the American Society of Civil Engineers was given over to the subject, and more recently at New York, where a number of technical societies held a joint meeting to discuss airport requirements of metropolitan areas. Speakers at the latter meeting included representatives of all those directly concerned with aeronautics—the Department of Commerce, the Army, the Navy, the Weather Bureau, operators of commercial airports and practical fliers. All emphasized the fact that the design and construction of efficient airports are an engineer's job.

W. P. MacCracken, Jr., Assistant Secretary of Commerce for Aeronautics, summed up the situation by saying that the laying out of an airport is just as much of an engineer's job as is laying out any other type of terminal. Any engineer skilled in that work could, he said, by studying the special requirements of airplanes, become proficient in the laying out of this newer type of terminal. Moreover, Mr. MacCracken said, the Department of Commerce is making no attempt to usurp the engineer's function in this work despite demands from many cities that the department lay out their airports for them. All the department does is to publish bulletins giving the minimum requirements for various classes of fields and a summary of what experience has shown to be the best practice.

This increasing importance of airports presents both a duty and an opportunity to the civil engineering profession. Almost every week sees one or more new airports proposed. All of them are not large or of complicated layout, but none is without essential features as to location, size and arrangement of the facilities which require an understanding of the fundamentals of airport design if they are to be both safe and efficient. Are civil engineers fully aware of the opportunities for service in this new field of activity?

Use the Streets at Night

MOST city streets are used intensively for only about half the time. During daylight hours they are crowded with traffic, but soon after the shops and factories close at night the traffic falls off greatly. This has long been recognized as an inefficient use of streets, but the obstacles in the way of changing the practice have appeared too great to be overcome. Now, however, when traffic has reached the saturation point on many of our principal thoroughfares, every way of increasing their efficiency by more fully utilizing their capacity needs to be re-examined. One of these ways is by delivering freight at night.

Night deliveries of freight, said Percy Straus, of the R. H. Macy Company, in speaking before the Public Safety Division of the Safety Congress at New York recently, is the quickest and cheapest way of increasing the day-time traffic capacity of our city streets. Mr. Straus does not speak as a theorist. The present efficient methods of moving freight and packages to and from the Macy store in one of the most congested parts of Manhattan Island have been worked out under his direction. Many of these movements are made at night and more would be made if outside concerns would co-operate.

In Chicago, where a great amount of department store incoming freight is handled off the street underground through an elaborate tunnel system, an attempt has been made to deliver coal by night, since the dumping requires transverse parking of the trucks with end dumps. Labor difficulties with drivers have prevented much night delivery, but Chicago is tending toward this method.

Night delivery of freight is not so complicated as it seems at first glance. To be sure, the system may require longer hours or additional hands at business houses where delivery is to be made after regular hours, but night deliveries can be scheduled for certain zones so that there need be no great amount of extra time. For the larger department stores in most cities the plan will be no great innovation. Many of these stores already deliver at night to their own outlying distributing stations. There is nothing new for the railroads in night movement of freight. They have practiced it for years. The only change they need to make is to increase the night staffs at their freight houses to take care of interchange with delivery trucks. Night deliveries present the greatest difficulty to the smaller merchants. For them it will mean having someone on duty part of each night to receive freight.

Slow-moving trucks and trucks unloading at curbs are now the chief causes of street congestion. If their number can be greatly reduced, traffic movements will be speeded up and the total number of vehicles in circulation cut down. This will help the city traffic and will

benefit the truck owners, because the same amount of freight can be moved with a lesser number of trucks, and ton-mile costs will be cut down by a reduction in lost time due to congestion. No costly street widening, street opening or other of the more elaborate schemes for traffic relief are required by this plan. It is obviously not the complete solution of the traffic problem, but it is a step in the process which deserves attention.

Forty Years' Progress

THE celebration three weeks ago in Chicago of the opening of the largest activated-sludge plant in the world marks 40 years of progress in sewage disposal. The plant completes one of the most important steps which the Sanitary District of Chicago, composed of 60 municipalities, has taken through a long term of years to protect Lake Michigan as a source of water supply for Chicago and other cities drawing on the south end of the lake. The plant stands as evidence of a thoroughly well-planned program of procedure, skillfully conceived and faithfully executed.

Scientific means of sewage disposal in the United States may be said to run concurrently with the life of the district, which was authorized in 1889 and adopted controlled dilution. The Chicago Drainage Canal, put into use in 1900, continued to rely on dilution until the water available for the purpose was no longer sufficient to care for the mounting volume of sewage. In 1909 scientific study of treatment methods began. In 1922 Imhoff tanks supplemented by sprinkling filters were installed at the Calumet works. Now comes the immense activated-sludge plant just opened. Some idea of its size may be gained from the fact that it is designed to serve 830,000 persons and a territory of 78 square miles; that its cost is $19,000,000, which, with 14 miles of interceptors, makes a total investment of $32,000,000; and that a large force of engineers has been engaged on its design and construction since 1921. Many unique mechanical and electrical devices have been incorporated in the plant. One of the largest switchboards yet assembled controls the multiplicity of motors in the pump and blower house. Novel types of meters measure the air and the sewage and record the results in three different places. Other features of the plant were described in last week's issue.

Unique in the entire history of sewage treatment is the pumping of the sludge 18 miles to the West Side plant. This gets the sludge out of a high-grade residence district and combines it with the sludge of still another huge plant for digestion drying on beds and final disposal as fill along the main drainage channel.

Although from the point of view of some extremists in sewage treatment piling up sludge is only a half-way or makeshift plan, yet at Chicago the primary object has been achieved, which is to reduce the burden of sludge and organic waste in the main drainage channel by producing a highly clarified effluent. There being plenty of space available for filling along the canal right-of-way, in a sparsely settled district possible ultimate conversion of the sludge into fertilizer can well be postponed until longer and more complete records are available from Milwaukee and Pasadena, which appear to be the only two activated-sludge plants in the world where an attempt is made to convert the entire sludge output into commercial fertilizer.

The Sanitary District of Chicago has always maintained a large, well-paid continuous staff. Further, in 1924-25 it did a unique thing in seeking the advice of 28 outside engineers, widely experienced in the various branches of engineering, to check up the general program under consideration by its own staff. Among the unanimous conclusions reached by these engineers was indorsement of the district's program for the construction of a series of great plants, including the North Side plant, just put into operation; the West Side plant, now well under way, and a future Southwest Side plant.

Predicated on the installations of these works at a stipulated rate was the federal five-year permit of 1925 for continued withdrawal of water from Lake Michigan. The required rate of construction has been greatly exceeded, so that the district will come to the War Department at the end of the period with overcompliance of both the letter and the spirit of the agreement, an accomplishment rarely attained in connection with the installation of sewage-works under the orders of a higher authority.

Increased Recognition

STRUCTURAL welding was well within the vanguard of subjects considered at the fall meeting of the American Welding Society at Philadelphia last week. A third of the papers centered on structural matters, and discussion was animated and well maintained. Even in some of the sessions devoted to other welding fields—for instance, aircraft joints and machinery fabrication—structural welding discussion cropped out. This is a good sign. Since its foundation the American Welding Society in its predominant collective thinking has been concerned with such subjects as shipbuilding, pipe-line construction and plate-work manufacturing. Until quite recently this collective thought has cataloged structural welding as only another interesting application of the welding art. That it had economic possibilities equal to or greater than the welding of ship hulls and pressure containers would hardly be admitted. Now a change has occurred. Although the American Welding Society as an entity has not been structural welding conscious, it has had within it a small group of members active as the structural welding committee. This group has drawn a large following from those members of the society not directly concerned with structural matters but anxious to support anything that is for safe welding advancement. The able leadership in and of this committee accounts largely for the present emergence of structural welding into the front rank of society activities.

Much credit for this increased recognition of structural welding should also be given the manufacturers of welding equipment. By taking the initiative in welded building and bridge construction, by well-considered publicity campaigns and by efforts to have welding recognized in building codes they have done much to put structural welding upon a practical basis.

Fortunately structural welding is developing sanely. For this reason if for no other it is certain to find its proper place. The new attitude of the American Welding Society disclosed at Philadelphia will have an important bearing on the destiny of structural welding. And with this society recognizing that building codes are as important as boiler codes, the civil engineering profession is assured of another virile influence in one of its important modern fields of activity. It is certain that the next year will see great strides in the welding of engineering structures.

Double Tracking on the Missouri Pacific Railroad

Traffic Speeded Up by Grade Reduction and Double Track for 125 Miles From St. Louis—Tunnels and Heavy Grading—Proposed Terminal Improvements—Construction Work

IN DOUBLE tracking and reducing grades and distance on the 125-mile line between St. Louis and Jefferson City, Mo., at a cost of about $14,000,000, the Missouri Pacific Railroad aims greatly to facilitate the heavy and increasing traffic between St. Louis and Kansas City, 279 miles, for which traffic it has competition from three other railroads. Beyond Jefferson City, the Missouri Pacific has two single-track lines to Kansas City, the shorter one by Sedalia, 154 miles, and the other following the Missouri River, 162 miles. The general situation is shown in Fig. 1.

Prior to the inception of the double-tracking program, the traffic had approached the economic limit of single-track operation, even with the automatic signal equipment. Between St. Louis and Jefferson City there are about 30 freight trains and sixteen passenger trains daily, including those running in both directions. This does not include fourteen suburban trains operating between St. Louis and Kirkwood, or a number of freight trains between St. Louis and Jedburg, 25 miles, which handle the output of three large gravel plants in the Meramec Valley. Under the old conditions, through freight trains sometimes required sixteen hours or more for the trip, on account of taking sidings to clear other trains traveling in the same or the opposite direction. These delays involved considerable expense in overtime wages and in sending out special crews to bring in trains whose crews had been on duty the legal limit of working hours. The time has been so reduced by double-track operation that the average speed of through freight trains between terminals is now about 18 m.p.h., as compared with 11 m.p.h. formerly. It is expected that further improvement will be made after completion of the work now under way.

When this improvement program was started in 1925, the division had only 13 miles of double track, from St. Louis to Kirkwood; and a short stretch into Jefferson City. The latter stretch extends 4 miles west of that city to Cole Junction, where the two single-track lines diverge (see Fig. 1). Four stretches of double-track aggregating 30 miles were built in 1925, and two more aggregating 22½ miles in 1926, while three stretches aggregating 24¼ miles, built in 1927, linked up a total of 95½ miles, except for a gap of 17 miles between Allenton and Boles. This gap will be closed by the 1928 double-tracking program. In this distance of 95½ miles there is single track only on the two bridges over the Gasconade and Osage rivers.

The easterly end of the 95½ miles of continuous double track is at Eureka, 29 miles from St. Louis, which distance includes the 13 miles of double track to Kirkwood and the last stretch of single track, 16 miles, between Kirkwood and Eureka. For the elimination of this final stretch of single track, study is being made for a low-grade bypass route south of the present line, avoiding the summit and heavy grades at Kirkwood, where the line, between Lake Junction and Valley Park, crosses the divide between the Mississippi and Meramec valleys. This low-grade bypass will have its eastern terminus at

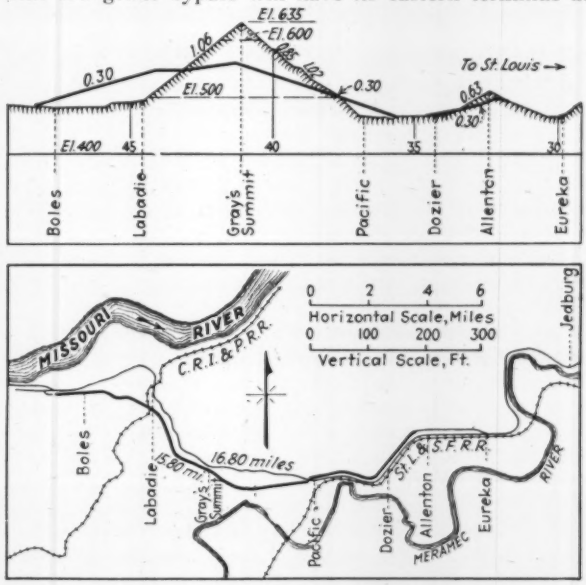


FIG. 2—GRADE REDUCTION AND DOUBLE TRACK, ALLENTON TO BOLES

the Ivory ferry of the Missouri Pacific Railroad over the Mississippi, but will provide for extension over a new bridge into the large terminal and interchange yard of the Missouri Pacific at Dupo, on the Illinois side, thus avoiding the congested switching territory of St. Louis.

At present, cars to and from industries or west side connecting lines are handled in the various Missouri Pacific yards in the heart of the industrial district, whereas cars moving beyond St. Louis to and from east side connections and the Illinois line of the Missouri Pacific are largely handled between the Dupo terminal

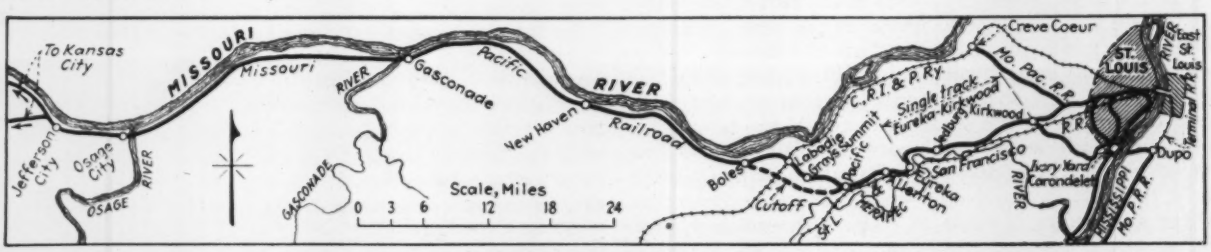


FIG. 1—MISSOURI PACIFIC RAILROAD, ST. LOUIS TO JEFFERSON CITY

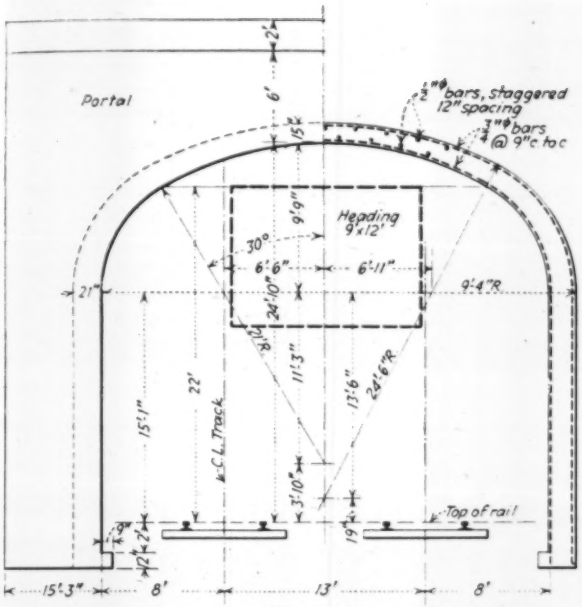


FIG. 3—TYPICAL TUNNEL SECTION. DOTTED LINE SHOWS HEADING

and Ivory yard at Carondelet, in the southerly district of St. Louis, by transfer boats on the Mississippi. If the proposed new bridge is built, it will eliminate the car ferry, as through freight trains will then operate between Dupo and Jefferson City over the bridge and low-grade bypass line, with a great saving in time.

Most of the double tracking done during the three years 1925-27 was in the bottom lands of the Missouri River, the opportunity being taken to improve the original alignment, which in general followed the river closely and had numerous and sharp curves. Here the alluvial land provides an unstable roadbed foundation, while the sliding débris along the rocky bluffs makes it desirable to keep the line at some distance from the bluffs. In spite of these difficulties, the curves on the improved line do not exceed 3 deg. and the maximum grades are 0.3 per cent. The correction of alignment made by the double-track programs, 1925 to 1928 inclusive, has eliminated 144 curves totaling 2,726 deg. of central angle.

Allenton-Boles Double Tracking—This 17-mile stretch now under construction (Fig. 2) is of particular importance: (1) The cutoff between Pacific and Boles reduces the distance 1 mile; (2) the summit elevation of the cutoff is 75 ft. lower than that on the old line; and (3) the grades of 1.06 and 1.02 per cent on the old line will be replaced with 0.3 per cent compensated grades in both directions, except for a temporary 0.5 per cent compensated grade 9,600 ft. long against the lighter westward trains. This temporary grade was inserted to defer track elevation through the town of Pacific, which would be required by a continuous grade of 0.3 per cent, but it is so located that it can readily be reduced to 0.3 per cent when business makes it necessary. Just west of Allenton the old line has a grade of 0.63 per cent for 1¼ miles against the heavier eastbound traffic, but this grade is being reduced to 0.3 per cent.

For the first 4½ miles from Allenton the new second track follows the old location, but beyond that it is the cutoff, 11½ miles long, built as a separate line on a new location keeping south of the old line and avoiding a long loop on the latter. This improvement is shown by the plan and profile, Fig. 2. In view of the advantages

FIG. 4—ROCK-CUT APPROACH TO TUNNEL

Steam shovel is taking out second lift. Cut has not reached portal. At right, above train of dump cars, is mouth of inclined drift to tunnel heading. Cable hoist pulls muck cars up to trestle to dump into standard-gage cars at right. Present main line at upper right, as indicated by switchstand.

of this cutoff, its track connections at each end will provide for operating heavy trains in both directions, leaving the old line largely for local business and for some of the lighter westbound trains. For the present one track only will be laid on the cutoff, but all cuts and fills, tunnels, concrete culverts and concrete bridge substructures are built for double track, so that this more favorable line may be readily double tracked when traffic conditions make it desirable.

Heavy grading is required on account of the rough and rolling country, and there are two double-track rock tunnels, one of which passes under the town of Gray's Summit. No large bridges are required, but there are two steel spans with concrete skeleton abutments.

Double-Track Tunnels—Two tunnels, 1,600 and 550 ft. long, on the 11½-mile cutoff are mainly in solid limestone with almost horizontal beds and occasional strata of sandstone. Excavation is made to a normal width of 32½ ft. and height of 29 ft. to allow for a reinforced-concrete lining 21 in. thick in the walls and 15 in. at crown of arch. A typical section is shown in Fig. 3, with the position of the main heading shown by dotted lines.

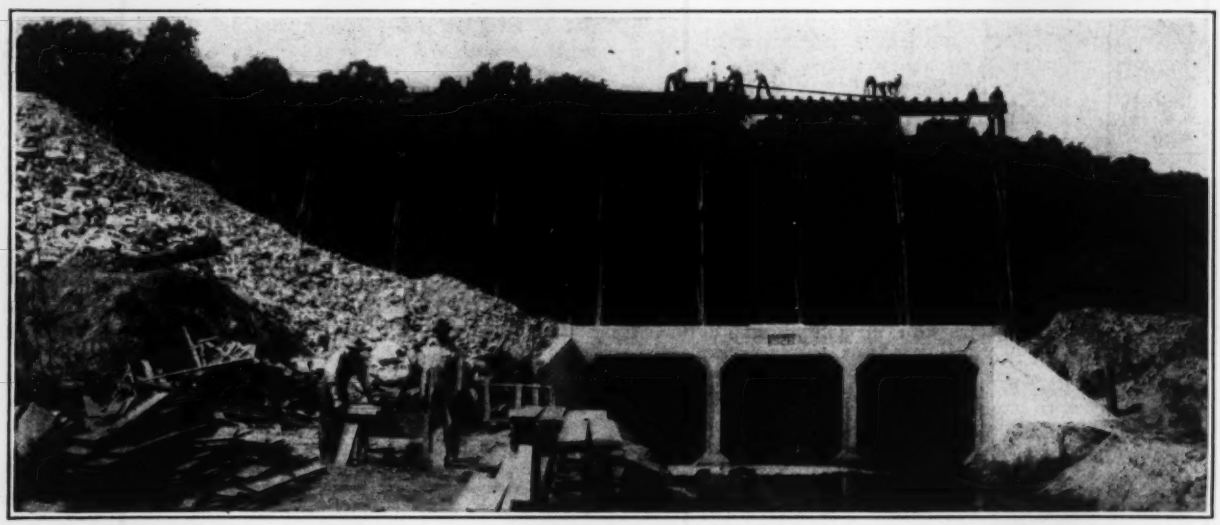


FIG. 5—CONSTRUCTION TRESTLE OVER TRIPLE BOX CULVERT

At the longer tunnel, which is being driven from the east end only, the east approach is a long and deep rock cut, shown in Fig. 4. In order to start tunneling before this cut reached the position of the portal, an inclined drift with a grade of 23 per cent was driven from the surface on the north side of the cut to the center line of the tunnel, the main heading, 9 ft. high and 12 ft. wide, then forming a continuation of the drift.

Muck is removed by small rectangular end-dump cars on 16-in.-gage track, being hauled by mules to the foot of the incline, up which they are hauled by a cable and steam hoist at the surface. The rock is then dumped from a trestle into 12-yd. dump cars, to be hauled to the nearest fill. In the heading the roof is flat and self-supporting, no timbering being required as yet. It is expected that the rock will disintegrate somewhat when exposed to the air, so that a continuous concrete lining will be required.

Work on this large heading is done in two ten-hour shifts, with an hour for meals in each shift. For each shift there are two drillers and eight muckers. Hammer drills are used exclusively. With 30 holes in the face, including four lifters, the advance is 7 to 8 ft. for each shift, or an average of 15 ft. per day. Blasting is done with 40 per cent dynamite. After each shot the compressed-air is left blowing through the two drills, so that in the two-hour interval between shifts the air becomes quite clear. A fan plant is on the ground ready to be installed if further ventilation should be found necessary. Only a little water has been encountered.

Electric current from a neighboring transmission line is used to operate the air-compressor plant. Light is furnished from the same source and the heading is exceptionally well lighted. This large heading will be driven through the entire length to the west portal. The top will then be taken out about 5 ft. higher for the roof arch and the sides will be enlarged to full arch section. The bench will be taken out in two lifts, an air-operated power shovel being then used for mucking.

Cuts and Fills—Widening old rock cuts and lowering grade in such cuts is troublesome and difficult work on account of heavy traffic and the necessity of avoiding delay while providing ample safety. In spite of these conditions, high side-hill rock cuts, with practically vertical faces, were widened without interfering with trains. In the intervals between trains, light shots were fired and the débris was promptly loaded on cars by a steam shovel.

At one shallow single-track rock cut a cut to the new grade was made parallel with the old roadbed, and the narrow-gage loading track was laid in this cut. Widening this cut at the new grade was done in two lifts, as the heavy blasting for a single lift would have disturbed or displaced the operated track and also would have covered it with so much loose rock as to cause considerable delay in removal. On this piece of work trains were given slow orders and proceeded under control up to the construction work, being then stopped unless the foreman gave a clear signal.

Hammer drills were used exclusively in the rock excavation. No heavy blasting was permitted by the engineers, for while it hastens the construction work it shatters and loosens the ground so that slopes of cuts are unstable and high maintenance cost may be necessary for several years. Blasting in cuts is done only fast

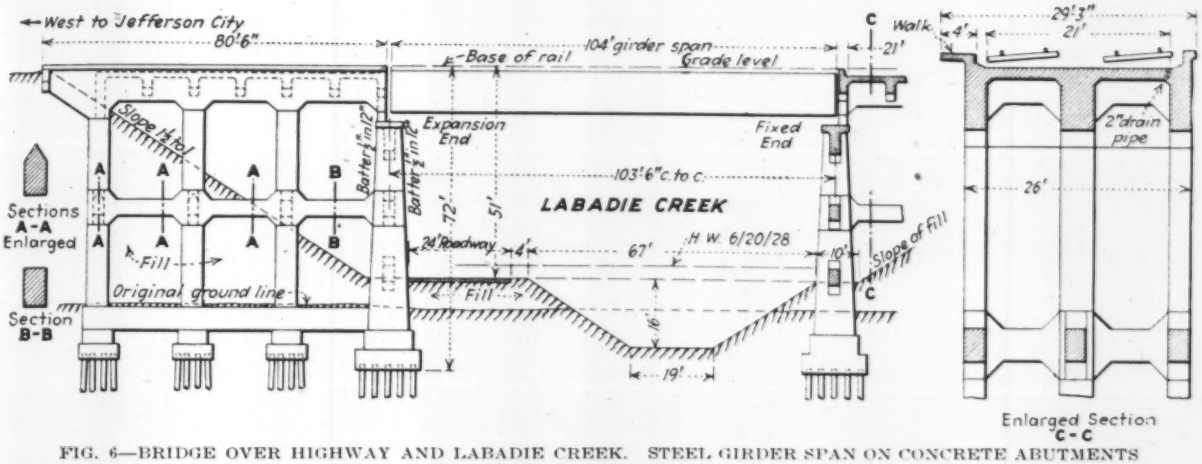


FIG. 6—BRIDGE OVER HIGHWAY AND LABADIE CREEK. STEEL GIRDER SPAN ON CONCRETE ABUTMENTS OF SKELETON TYPE

enough to enable the work to keep ahead of the shovels. Much of the fill consists of rock from the tunnels and cuts, and it is all made by side dumping from temporary trestles, as shown in Fig. 5. Both 4-yd. and 5-yd. narrow-gage and 12-yd. standard-gage equipment is used by different contractors. One rockfill is 40 ft. high and another is 60 ft. The latter was made in two 30-ft. lifts, with a second trestle on the completed part of the first lift. In extending the first lift, trains of eight 4-yd. cars were taken by gasoline locomotives down a grade of 7 per cent from the shovel cut to the fill and trestle. At the westerly end of the cutoff, where the new line approaches the connection with the old line, the toe of the new fill would have encroached for a long distance upon the existing track, hence it was necessary to throw out the old line to a new location.

A special feature of the excavation work on the cutoff is the construction of large drainage ditches parallel with the cuts, the near edge of ditch being not less than 25 ft. from the top of the slope. These ditches were dug, generally by drag-line outfits, before beginning work on the cuts, in order to prevent delay by flooding from the side hill run-off during heavy rains. The normal roadbed width for double track is 43 ft. in cuts and 39 ft. on fills.

Bridges and Culverts — On the Gray's Summit cutoff the principal structures are a 104-ft. steel span over a highway and Labadie Creek (Figs. 6 and 7) and a 40-ft. steel span over the Chicago, Rock Island & Pacific Railway. Both are deck-girder bridges with concrete frame or skeleton abutments which are partly buried in the end slopes of the fill. These abutments have solid decks for ballasted tracks, but ordinary open-deck construction is used on the steel spans. As the larger structure is within yard limits at Labadie, switching movements may be operated over it. To provide for the safety and convenience of yard men, the south side of the bridge has a sidewalk slab 4 ft. wide, protected by an iron pipe railing as shown.

This Labadie Creek bridge, on a 2 deg. curve, is 266 ft.

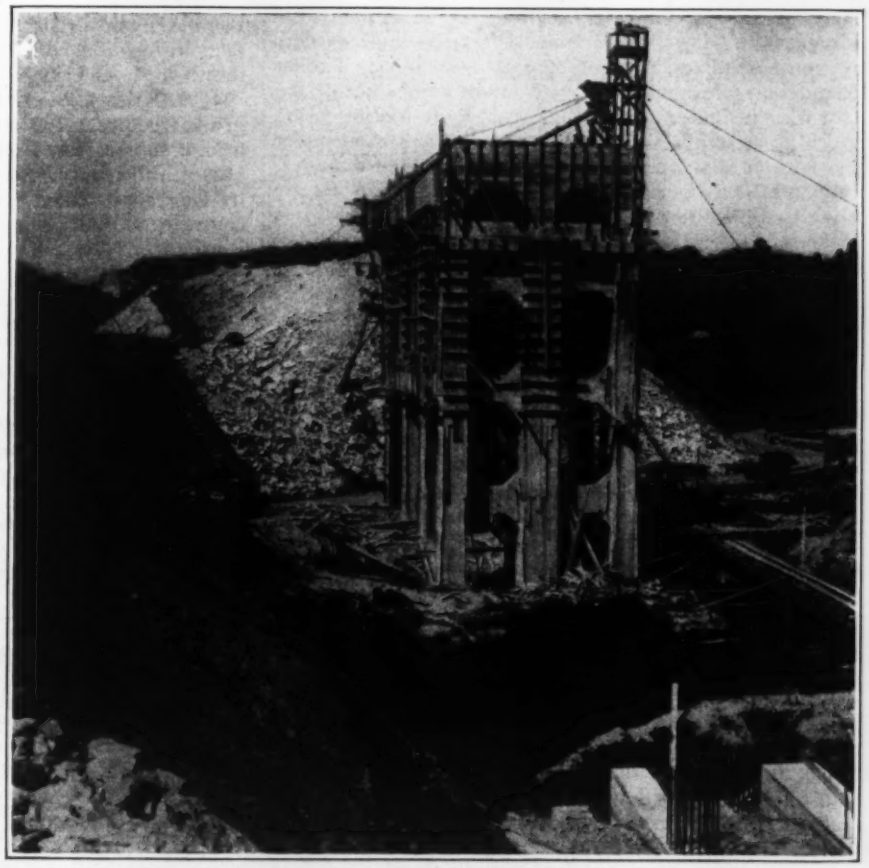


FIG. 7—CONCRETING A SKELETON ABUTMENT
Foundation sills for east abutment in foreground. Rockfill approach in rear, with temporary construction track and trestle at left.

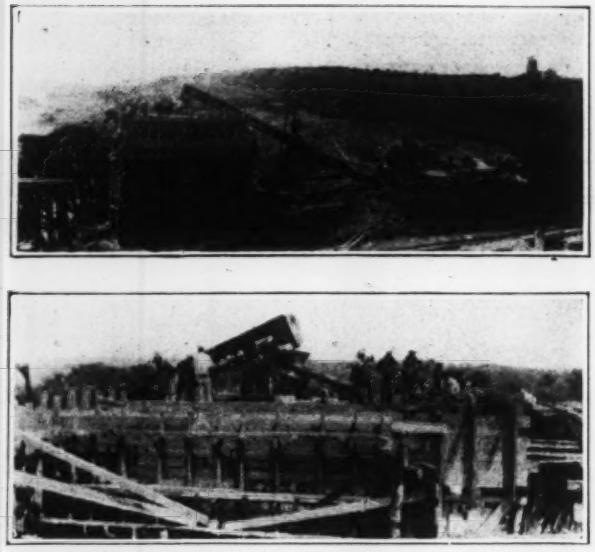


FIG. 8—BRIDGE OVER ROCK ISLAND LINES
Above—Conveyor delivering concrete into form for pier.
Below—Hopper and chute receive concrete from head of conveyor.

long, with reinforced-concrete skeleton abutments of 81 ft. each, carrying a 104-ft. steel deck-girder span. Each abutment (Fig. 6) has four three-post bents connected by longitudinal and transverse struts and by sills at the footings. At the top are longitudinal girders with transverse beams supporting the 6-in. deck slab. On the pier carrying the steel span these concrete girders rest on zinc plates, forming an expansion joint. Timber foundation piles under the transverse footings are driven to rock, the outer rows of piles at each footing being given a batter of 1 in 12. Fill material is packed under the bottom struts and under the rear cantilever projections of the concrete girders. The struts, which are buried within the fill, are made with tapering tops so as to allow for settling and compacting of the material.

For concreting, a mixer was installed at each structure. Concrete was handled in different ways. In some cases a hoisting tower and dump bucket served a spouting system. At the bridge over the Chicago, Rock Island & Pacific Railway, a portable inclined conveyor delivered the concrete through a hopper-headed pipe or chute, as shown in Fig. 8. Here a pipe operated like a tremie was used in the columns and walls, being raised as the form was filled.

For a foundation at a little distance from the mixer, a dump body was mounted on a home-made motor-driven car. One man with this car could place as much concrete as several men with wheelbarrows. Bituminous waterproofing is applied on the deck slab and on part of the work buried in the fill. All exposed concrete is rubbed down with carborundum brick and water to give an even surface and uniform color.

Of minor structures, the most numerous are concrete box culverts and highway underpasses, and concrete pipe culverts. One of the larger box culverts, shown in Fig. 5, has three openings 10x11 ft. and is 168 ft. long, being in a fill with roadbed wide enough for three tracks.

Track Construction—All new tracks are laid with 90-lb. rails on creosoted ties, fully tie-plated, and are ballasted with zinc-mill chat from the Joplin territory and with Meramec River gravel. Not less than 12 in. of ballast is placed under the ties, of which the lower 8 in. is gravel and the upper 4 in. is chat. At each end of the cutoff its present single track will be connected with the adjoining sections of double track by a pair of No. 20 crossovers operated by interlocking from near-by cabins to provide for the most convenient and flexible operation of trains in both directions.

On the stretch of double track between Allenton and Pacific an interior siding accommodating a 100-car train with locomotive and caboose will be provided. A siding of the same capacity will be constructed on the cutoff a short distance west of the summit. The location of these sidings and the spacing of similar sidings built on other sections of the double track contemplate a spacing of about 10 miles for sidings on the entire district. Automatic signals governing movements in both directions on each track are being installed in connection with all double track.

Tracklaying on the double-track work has generally been done by contract. This method has been found to be somewhat more satisfactory than construction by company forces, as the contractor can readily secure the necessary experienced track men and the construction by contract avoids interference with the programs of the track maintenance forces of the railroad.

Engineers and Contractors—This improvement work is under the general direction of E. A. Hadley, chief engineer, Missouri Pacific Railroad; C. S. Sample, construction engineer, has direct charge of construction, and F. E. Bates is bridge engineer. The work under construction between Allenton and Boles is divided among three resident engineers; R. L. Ehrlich has the section from Allenton to Pacific; E. L. Freeland has the middle section, including the longer tunnel; and R. P. King has the westerly end, including the shorter tunnel.

J. A. Kreis & Sons, Inc., of Knoxville, Tenn., has the general contract for the grading, tunnels, culverts and bridge substructures, and is constructing with its own organization the longer tunnel at Gray's Summit, with its long approaches; F. E. Maloney is engineer for the contractor. On the concrete work, Hedges & Weeks, Springfield, Mo.; Campbell & McGregor, Hermann, Mo.; and the Ozark Engineering Company, Joplin, Mo., are subcontractors. For the grading, the subcontractors are Costello Brothers & Mays, Knoxville, Tenn.; Crippen Construction Company, Knoxville, Tenn.; J. P. Bogard, Knoxville, Tenn.; M. L. Windham, Centralia, Ill., and G. L. Mays, Knoxville, Tenn.

Construction was begun in March, 1928. It is expected that the section of double track between Allenton and Pacific, including the grade revision at Allenton, will be completed by January, 1929, and that the cutoff will be completed and in service by Sept. 1, 1929. The estimated cost of the 17-mile section comprising the 1928 program is about $4,000,000.

British Town Buys French Water Pipe

Purchase of water pipe made in France at a price 7s. ($1.70) per long ton less than that offered by British manufacturers was recently decided on by the Chelmsford (England) Rural District Council. In reporting the action, *Municipal Engineering* (London) says: "A member of the council, who protested against this action, expressed the opinion that for the sake of a few pounds the council were throwing their fellow countrymen out of work and giving money to foreigners." The journal then asks, "What do the ratepayers think about it?"

Meter Placing and Maintenance in New York Water Department

Property Owners Buy Meters From Company Stock Approved and Tested by City—Plumbers Set and Repair

THE use of water meters in New York City is optional except on services supplying stores, hotels, office buildings and places where water is furnished for commercial use, in which cases the Commissioner of Water Supply may compel the installation of meters. In apartments, tenements and private dwellings, water meters may be installed upon written demand of the owner or when authorized by the Board of Aldermen. Unmetered water is sold at a flat rate, varying with frontage, height and fixtures of the building and number of families residing therein; the owner is responsible for the water consumed. Out of 570,000 services in the whole city 138,000 (24 per cent) are metered.

In accordance with the provisions of the city charter, all water meters installed in the city to measure water furnished by the city to its customers must be approved as to pattern and maximum price by the Board of Aldermen. The property owner is required to pay all expenses of meters, their connection, setting and repair. He has a choice of any one of a number of different makes of meters that have been approved by the Board of Aldermen. Each meter must be tested by the Department of Water Supply before being placed. A stock of small meters which have been tested and approved is kept on hand at the meter-testing shop, no charge being made for testing meters. These meters are the property of the various companies and are kept on hand merely to facilitate distribution. Licensed plumbers and employees of the Department of Water Supply, Gas and Electricity are the only persons authorized to install or remove meters. The department has no force available for this work and the owner who desires or is required to install a meter must, therefore, obtain the services of a licensed plumber. The plumber, after receiving instructions from the owner, makes application to the bureau of water register for a permit to perform the work. After receiving the permit, he purchases for the owner one of the approved makes of meters of the size called for in his permit. The plumber does not receive the meter directly from the manufacturer, but he is given an order on the department's meter-testing station, where he must present his order together with his permit before the meter purchased, which has been tested, approved and sealed, is delivered to him.

In the setting of meters, a stopcock or valve is required on 1-in. or smaller services between the main and the meter and within 1 ft. of the meter. When larger meters are used, valves are placed on both sides of the meter and the department's approval of the proposed location is required before the installation can be made. Meters set in pits require special permission and the pits must be of certain dimensions depending upon the size of the meter. When a building is located back from the street line a considerable distance or when conditions in a building prevent locating the meter inside the building near the point of entry of the water service, the meter may be set outside of the building and a watertight and frostproof meter box used.

When repairs to meters are necessary, a repair permit must be obtained from the water department by a licensed plumber, who then removes the meter and sends it either to the manufacturer or to a meter repair company. Special permits are also granted to the meter companies to repair large meters without removing them from the services. Repairs to meters must be made within two weeks of their removal. The meters are then forwarded to the department testing shop. If the meter registers correctly, the plumber is notified and is then given five days in which to reset the meter.

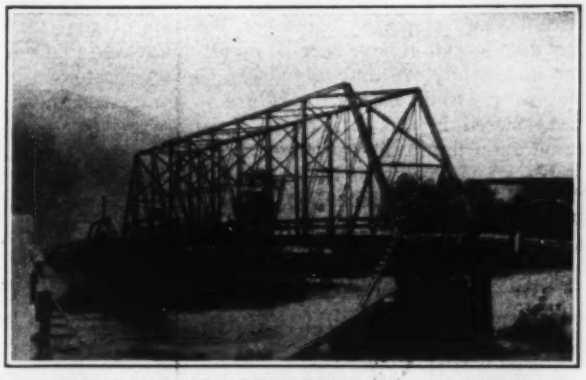
The only repair work done by the department is the packing of leaky meters and the replacement of broken register glass. For the latter operation there is a charge of $1. Metered water is paid for at the rate of 10c. per 100 cu.ft. with no minimum annual charge.

All work incidental to the issuance of permits to plumbers for setting and repairing water meters is under the bureau of water register of the Department of Water Supply, Gas and Electricity. The testing of meters is under the bureau of water supply.

Old Timber Truss Bridge Being Replaced By Steel Structure

By F. M. Goodhue
Siloam Springs, Ark.

THE 200-ft. span through-truss timber highway bridge near Orick, in northern Humboldt County, California, which is being replaced by a new steel structure, is unique in a number of particulars. It was placed in service about 25 years ago and since has carried the entire traffic of the Redwood highway. The span of 200 ft. is considerably longer than the average for such a structure and the conditions under which it was built were far from perfect. The nearest railroad was about 50 miles distant and there was no sawmill at the site. Redwood timber from adjacent forests was used. The designer, who was also the contractor, was Frank Smith. The bridge was built for Humboldt County.



THROUGH-TRUSS TIMBER BRIDGE IN CALIFORNIA

Redwood has fair compressive and poor tensile strength. Full account was taken of this in the design, all bracing between the top chords as well as between the trusses being of redwood in compression. Tension members are of ¾- or 1-in. steel rods. All timber members were hewn to dimension by hand. The bottom chord member of each panel is doubled steel bar 3x1⅛ in. The floor beams are 14x14-in. timbers. The approach spans are also of timber construction, about 30 ft. long and apparently much stronger than the main span.

Submerged Contact Aerators for Sewage Treatment

Three Years' Experience and Improvements, During Which Time Ten Plants Have Been Equipped in Germany

By Karl Imhoff
Chief Engineer of the Ruhrverband, Essen, Germany
Translated from the German
By A. M. Buswell
Chief, Illinois State Water Survey Division, Urbana, Ill.

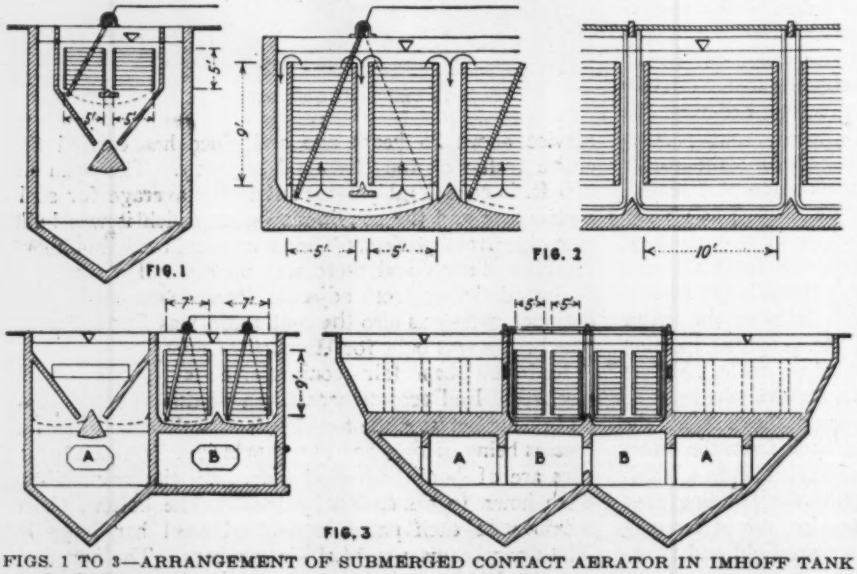
Dr. Imhoff brings to date his early account of the use of submerged contact aerators to increase the efficiency of Imhoff tanks. He states that the devices may be placed between Imhoff tanks and activated-sludge plants, greatly reducing the aeration period in the activation tanks. —Editor.

In *Engineering News-Record* for Dec. 9 and 23, 1926, I described the first investigations of sumberged contact aerators made by the Ruhrverband in Essen. A more complete description of these devices appeared at the same time in my book [in Germany], "Progress of Sewage Purification." The studies had then been carried on for one year. Since then the investigation of these devices has been continued for two more years. The studies have been made at ten different plants, of which eight are fed with city sewage and two with industrial wastes—from a wool washery and phenol wastes. The later experiments have confirmed earlier conclusions in all important respects. However, methods of construction and operation have been so greatly improved that we can now safely say that submerged contact aerators will play an important part in the future of sewage treatment.

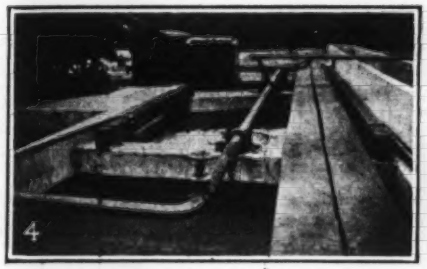
As stated in the earlier article, our work has been based upon the investigations and conclusions of Travis, of Black and Phelps, of Bach, and of Buswell. The practical application of submerged contact surfaces depends upon the observation of Buswell to the effect that the organisms which grow upon the submerged surfaces must be regularly washed off. The process depends, therefore, primarily on micro-organisms. If these are not regularly removed, they clog the openings of the contact material. If, however, they are removed and can in any way settle and collect, they quickly become putrid and take up so much oxygen that the action of the submerged contact aerators is soon reversed. It is necessary, therefore, that the sludge which is washed off (the bacterial growths) be removed promptly from the submerged contact aerator chamber. On this account we first hung submerged contact aerators in the sedimentation chambers of Imhoff tanks so that the sludge would settle of itself into the sludge digestion chamber (Fig. 1). We have now abandoned this method of construction, because too much of the space below the submerged contact aerators was unused and therefore wasted. This construction is to be considered only in cases where old Imhoff tank installations whose sedimentation chambers are too large are to be improved through the installation of submerged contact aerators.

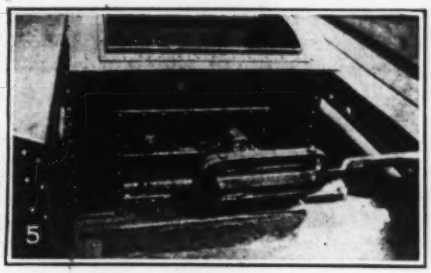
In new installations we now install submerged contact aerators in special tanks with horizontal bottoms close to the contact bodies. This is possible, since a method has been found to prevent the sludge from settling on the bottom and to remove it quickly and promptly. The bottom of the submerged contact aerator chambers is built slightly curved to conform to the arc of the swinging air pipe with which the compressed air is furnished to the submerged contact aerators (Fig. 2). The swinging pipe thus sweeps the sludge from the bottom and forces it into the sedimentation basin which follows the submerged contact aerator chamber. We have installed this type of sumberged contact aerator tank in Imhoff tanks in the new plants at Velbert and Menden (Fig. 3). In large installations it would be more practical to install submerged contact aerators in independent tanks as shown in Fig. 2.

The swinging air pipe described in my previous article has proved more advantageous than at first reported. There is no other arrangement with which it is possible to distribute a small volume of air so uniformly over a large surface. The air is led from the fixed air pipe through a 2- to 3-ft. rubber hose (Fig. 4) attached to the axis of the movable pipe. A small motor (Fig. 5) produces the pendulum-like motion of the swinging air pipe through a rack and pinion. The air pipe extending underneath the submerged contact aerators has perforations at about 6-in. intervals. The perforations must be placed on the under side so that the pipe will not become clogged with sludge and so that the air will be discharged uniformly. The size of the perforations are such that their area is about 30 per cent greater than the area of the air feed pipe. The air openings have then a diameter of 5 to 8 mm. The swinging pipe makes from two to six oscillations per minute. To clean off the accumulated sludge Buswell gives the submerged contact aerators an up-and-down shaking motion at intervals. We have accomplished the same result by blowing all of the air through the



FIGS. 1 TO 3—ARRANGEMENT OF SUBMERGED CONTACT AERATOR IN IMHOFF TANK
Oscillating air pipe below wooden slats. In new tanks, the movement of the air pipe prevents sedimentation of sludge. Note waste space when contact aerators are installed in old Imhoff tanks.





FIGS. 4 AND 5—MOTOR AND MECHANISM FOR MOVING AIR PIPE
Rubber hose (in Fig. 4), just beyond valve in foreground, connects stationary and movable air pipes; pipe-moving mechanism in left background. Fig. 5 is a close-up of the mechanism.

aerator pipe of each unit successively for a short time each day. Since each swinging pipe is provided with an individual valve, this operation is accomplished very easily.

In the first submerged contact aerators we used coke and brushwood as filling material, but we have now given up their use, because it is impossible to keep them completely free from sludge. We now use only the veneer mats suggested by Buswell (which, however, are not placed vertically, but somewhat inclined) or horizontal wood laths, which are placed on a slant so that no sludge can deposit upon them (Fig. 6). The wood laths are placed parallel to the axis of the swinging air pipes. The horizontal laths are particularly advantageous, since they present considerable resistance to the air bubbles and produce good distribution. Fig. 7 shows that the distribution of the air is so uniform that it is impossible to determine the position of the swinging air pipe. This photograph was taken at the installation at Velbert, where the air pipe makes six oscillations per minute, which is rather fast.

Town or Industrial Plant*	Sewage Volume, M. G. Per 14-Hr. Day	Volume of the Submerged Contact Aerator Chamber Equivalent to Sewage Flow of Minutes	B.O.D. of Settled Sewage	Decrease in B.O.D. After Submerged Contact Aerator Treatment, Per Cent	Decrease of Permanganate Oxygen Demand After Submerged Contact Aerator Treatment, Per Cent
1. Kettwig	0.52	5	362	36	16
2. Langendreer	0.52	5	94	31	30
3. Hagen	0.41	10	134	27	24
4. Iserlohn	0.37	22	199	36	21
5. Essen-Rellinghausen II	0.47	12	...	..	38
6. Velbert	0.67	32	219	36	37
7. Blankenstein	0.09	80	362	36	36
8. Menden	0.67	150	240	69	58
9. Kettwig Wollwäschereiwasser	0.07	60	...	..	..
10. Mansfeld Phenolwasser	0.13	175	...	..	..

*The first eight are city sewage-works; the last two, industrial plants.

It is obviously necessary that the sewage while passing through the submerged contact aerators continuously circulates so that it passes through all parts of the submerged contact aerators several times. Our submerged contact aerators are, therefore, placed in wooden boxes open at the bottom and top. The air is introduced only within these boxes. In consequence the sewage is raised upward through the boxes and flows over the edge (Fig. 2). The upper edge of the box must be placed a few inches below the water level so that this circulation is possible. About 6 to 12 in. must be allowed between the boxes so that the sewage can return freely to the bottom again to be raised by the air, thus maintaining free circulation. According to our measurements the sewage during a flowing-through period of one-half hour circulates 25 to 30 times through the submerged contact aerators. It is obvious that this circulation aids the purifying action. In order that the circulation may be as complete as possible the boxes should not be built too wide. They are at most 5 ft. wide. The length runs up to about 10 ft. The depth of the boxes is 5 to 9 ft., according to local conditions. The boxes, when lath is used as surface material, are so arranged that they may be removed as separate units. If the water level can be lowered below the bottom of the boxes, this provision is not necessary. The swinging pipes are installed so that they may be put in and taken out independently.

A definite air requirement is necessary for the contact surface unit in order to provide the necessary circulation. We calculate 0.2 ft. per square foot per minute. In deeper units the air requirement calculated against the surface is no greater. It follows, therefore, that the deeper installations in general require less air. The air requirement also depends upon the detention period which is necessary and the degree of purification to be obtained. As an average we figure for a detention period from one-half to one hour that the air requirement will be 0.2 cu.ft. per gallon of sewage. Fresh sewage requires less air than stale sewage. Submerged contact aerator installations are built so as to provide sedimentation of the sewage both before and after contact with the submerged surface. It is advisable to provide from three-fourths to one hour for each sedimentation period.

Under no conditions may sludge be allowed to accumulate at any point in the submerged contact aerator chambers. Otherwise the purification action is reversed, since putrefying sludge takes up oxygen. The bottom of the submerged contact aerator is built to allow not more than 2 in. clearance for the swinging air pipe. Portions of the tank which are not swept by the swinging air pipe must be built with a slope of at least 1.5 on 1.

The operating results of the submerged contact aerator installation of the Ruhrverband are given in the table. With a submerged contact aerator chamber of volume corresponding to a sewage flow of 30 to 60 minutes,

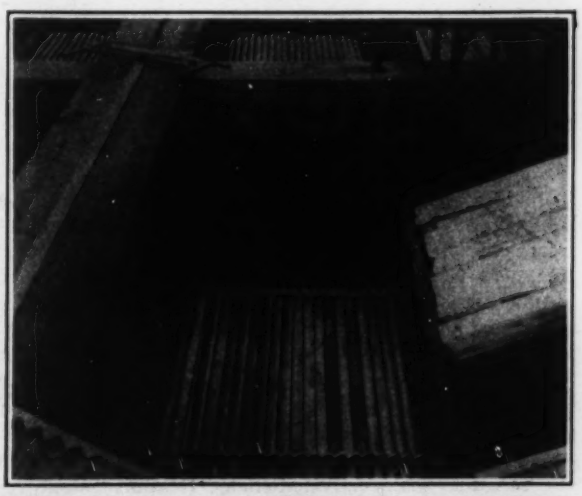


FIG. 6—WOOD-SLAT SUBMERGED CONTACT AERATORS

sewage which has undergone preliminary sedimentation will be further purified so as to produce a 30 to 40 per cent decrease in B.O.D. This corresponds to about one-half of the purification which would be produced by complete biological purification. The purification may in some cases, where particular trade wastes are present (for example, iron salts), be considerably higher. If the detention period is increased (for example, to four hours), it is possible to effect a purification equivalent to complete biological treatment. In this case the submerged contact aerators are built in two to three stages between which small sedimentation chambers are placed to catch the sludge washed from the contact surfaces. For the last stage brushwood or coke may be used as filling material, since bacterial growths no longer occur there. Such submerged contact aerators for complete biological purification do not appear to be economical, because in construction and operation they become somewhat more expensive than activated treatment.

In Germany the cost of Imhoff tank installations for towns of 20,000 inhabitants amounts to about 120,000

FIG. 7—SUBMERGED CONTACT AERATOR IN USE
Good air distribution by moving air pipe, location of which cannot be detected from appearance of air bubbled at surface.

marks and for the submerged contact aerator which may be built inside the Imhoff tank the cost is 12,000 marks (that is, the submerged contact aerator costs 10 per cent of the cost of Imhoff tanks). If the submerged contact aerators are built in tanks outside the Imhoff tank, the cost is increased by 18,000 marks, making altogether 30,000 marks (25 per cent of the cost of Imhoff tanks).

The advantages of submerged contact aerators are small area, small construction cost and simplicity. They are also much less affected by poisonous industrial wastes than, for example, is activated sludge. The field of the submerged contact aerator is primarily partial biological treatment. It is to be chosen when complete biological treatment is not necessary but where sedimentation is insufficient. The increased cost compared with ordinary sedimentation installation is so small that they will doubtless be installed in places where at the present time sedimentation alone is used. In activated-sludge installations submerged contact aerators will undoubtedly become of great importance as providing an intermediate stage between sedimentation and activation. We have found in one case that plain activated-sludge treatment alone requires an aeration period of eight hours but that by the combination of submerged contact aerators and activated sludge treatment the aeration in the activated-sludge treatment could be reduced to four hours by giving preliminary treatment of one hour in submerged contact aerator tanks, making the over-all period five hours for the combined treatment as compared with eight hours for activated-sludge alone.

There is also the better suitability of the combined process to the change of seasons and quality of the sewage and the better protection of the sensitive activated sludge against the effect of industrial wastes. The submerged contact aerators may be used as pretreatment devices for sprinkling filters just as the activated-sludge process has been.

High-Type Highways Increasing in the United States

With the co-operation of state highway departments, 8,184 miles of federal-aid highways were improved in the fiscal year 1927-28 and 2,014 miles that had been previously improved by federal aid were given surfaces of higher type, according to the U. S. Bureau of Public Roads. This work was done at a total cost of $205,043,784, of which the federal government paid $88,056,984, or 43 per cent, and the states paid the balance.

Under supervision of the bureau, 281 miles of national forest roads were improved, bringing the total improved mileage of these roads to 3,775. The national forest road system embraces, at present, a total of 13,911 miles.

In the federal-aid system there are 187,753 miles of interstate and intercounty highways, of which, on June 30, 71,074 miles had been improved with federal assistance and 1,285 miles were undergoing stage construction—that is, were being given a higher type of surface than when previously improved with federal aid.

The 8,184 miles improved in 1928 include 2,182 miles of graded and drained earth roads, 844 miles of sand-clay, 1,836 miles of gravel, 92 miles of waterbound macadam, 464 miles of bituminous macadam, 136 miles of bituminous concrete, 2,533 miles of portland cement concrete and 42 miles paved with vitrified brick. There were 54 miles of bridges and approaches.

Federal-aid highways are the most heavily traveled in the country. Increased demands of a growing traffic are shown by the greater increases in the types more suitable for heavy traffic. The mileage of high types of pavements built, such as bituminous macadam, bituminous concrete, portland cement concrete and vitrified brick, increased 19 per cent in 1928, while the mileage of low types, such as waterbound macadam, gravel, sand-clay and graded and drained, increased about 9½ per cent.

Tests Made of Rubber on Rails to Absorb Vibration

Tests have been made in the Federal Malay States of a special process rubber, installed on the right-of-way of a railway, to deaden sound and absorb vibration, it is reported to the U. S. Department of Commerce. Pads of the rubber were installed on one rail length of a permanent way, with a view to prevent abrasion between the rail and the tie, deaden the sound transmitted to the coaches and absorb the vibration delivered to the permanent way. It is reported that the initial tests were so satisfactory that commissions have been ordered to equip a mile of track on the main line.

Building Rapid-Transit Viaduct, Kansas City

Varied Problems and Features in Design and Construction of Short Steel Structure Carrying Electric Street-Car Line Across Groups of Railway Tracks

By S. E. Berkenblit
Structural Engineer, Chicago, Ill.

Engineers and Contractors had to exercise both skill and ingenuity on the viaduct described in this article. In a length of only 1,850 ft. it includes truss and girder spans, pin-connected floor beams in trusses, special floor construction, extreme skews, grades of 1.6 to 8.3 per cent, sharp curves, rehabilitation of a stretch of old structure and adaptation of the new steel work to old foundation footings. The substructure includes steel bents, new piers, a concrete extension of an old stone pier and a pier built as part of a freight house wall (with doors and windows). Erection work involved difficulties due to crossing busy railway tracks and yards.—Editor.

By its recent reconstruction of the Ninth St. viaduct the Kansas City Public Service Company has restored an elevated rapid-transit route through a manufacturing district in the low-level area between Kansas City, Mo., and Kansas City, Kan. The original viaduct, a wrought-iron structure built in 1887, extended west from the portal of the Eighth St. tunnel at Bluff St. to the Kaw River bridge. East of the tunnel there was an elevated structure on Ninth St. and Central Ave., but this has been removed and replaced by surface tracks. Although some of the structure west of the tunnel was largely rebuilt in 1904, a part of it soon required continual repairs and investigations, and after a serious failure in a truss chord member in 1919 the entire structure was condemned and service discontinued.

The present double-track structure, 1,850 ft. long, is new, except for 375 ft. of the viaduct rebuilt in 1904, where corroded members have now been replaced and new station platforms built. It is designed for double-track electric cars 43 ft. 3 in. long weighing 45 gross tons with 25,000-lb. axle loads, and 25 per cent allowance for impact. A general view of a portion of the structure, with long reversed curves, is shown in Fig. 1, while Fig. 2 gives a condensed plan and profile.

Besides one through-truss span and one deck-truss span the structure is of plate-girder construction, with columns supporting transverse girders between which the longitudinal girders or track stringers are framed. Lateral bracing and cross-frames or sway bracing conform to ordinary elevated railway construction. However, where columns are widely spaced for clearance of surface cars or other conditions, there are longitudinal girders between the columns, with transverse floor beams to carry the track stringers, as in bridge floor framing. Most of the new steel work is carried on the old footings and piers, the caps of piers being remodeled to fit the new bridge seats. Both line and grade were governed by existing conditions, requiring numerous curves and changes of grade, so that very accurate surveys were necessary to insure fitting the new work to the old substructure. These surveys were made by the company's engineers and checked by the engineers in charge of designing the new structure. In erection, the steel was found to fit exactly and for the 335-ft. truss span the base plates checked on the masonry to within $\frac{1}{8}$ in.

FIG. 1—RAPID-TRANSIT VIADUCT AT KANSAS CITY
In foreground is 118-ft. deck truss span over tracks, with through-truss street bridge beside it. Beyond is elevated railway structure on descending grade of 4 per cent and with 12 deg. curves. Footbridge connects station with industrial district at right. Last curve crosses freight house and enters 335-ft. through-truss span.

General Design—Beginning at the east end, there are two elevated-railway spans of 82 and 77 ft. (see Fig. 2) on a grade of 4.35 per cent and having the ends skewed 54 deg. with the center line. On the new abutments the back walls were squared so that both wheels on an axle pass on and off the structure simultaneously. An old steel bent for the center support was replaced by a reinforced-concrete girder pier on the old foundations.

A riveted deck-truss span on the same grade comes next, giving a clearance of 26 ft. 3 in. over the tracks of the Chicago, Burlington & Quincy Railroad and the Kansas City Terminal Railway. This span (Fig. 3) averages 118 ft. in length, but the north truss is 113 ft. 10 in. and the south truss 122 ft. 5 in. long, with the east end skewed 54 deg. 18 min. and the west end 42 deg. 6 min. At the east end the trusses are seated on steel rockers. At the west or fixed end they rest on a box girder bent designed to resist all the tractive force from moving trains.

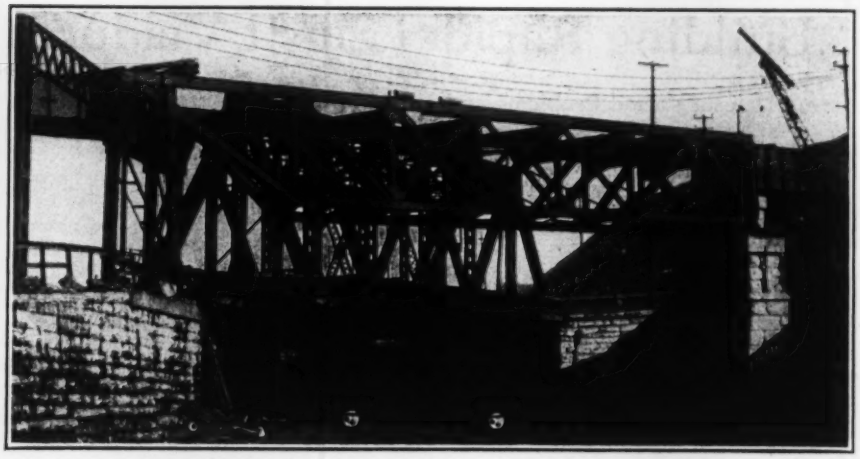


FIG. 3—DECK-TRUSS SPAN WITH SKEWED ENDS
Beyond it is the St. Louis Ave. bridge, with through trusses.

The next two spans, 69 and 51½ ft., are of elevated railway type, with all ends skewed; the tracks are on a grade of 4.35 per cent and a 12 deg. curve. As these spans replace one old truss span, a new supporting bent was needed (No. 7, Fig. 2). But this bent comes at a street intersection, so that it was necessary to space the columns 86 ft. apart, carrying a cross-girder 90 in. deep and having heavy struts and bracing. This long girder appears in Fig. 1.

Beyond this is the 375-ft. length of old structure rebuilt in 1904, for which an analysis of stresses indicated sufficient strength for the new loadings. While the major portion of the steel showed good physical condition, serious deterioration had occurred in the top flanges of stringers and floor beams, bracing and connections. All corroded members and parts were cut out and replaced. New bracing was also added to give additional stiffness. On this section there are two 12 deg. curves at either end, with tangent track between and grades of 4 and 3 per cent. It is followed by four new elevated-railway spans on 1 per cent grade and 12 deg. curve. The last two spans cross the Wabash Railway freight house, and bents 20 and 21 have each one column built into the rear wall of that structure, while the north column of bent 21 stands inside the building.

Through-Truss Span—The crossing over the Wabash Railway and Missouri Pacific Railroad tracks presented a troublesome problem, due to the severe skew of the structure and the limiting conditions for side clearances. There the old viaduct consisted of three pin-connected through-truss spans of 141.6 ft., 103.9 ft. and 86.2 ft., supported by steel bents, all the tractive effort being taken at a heavy stone pier at the west end. These old bents, however, did not provide the standard side clearances for adjacent Wabash Railroad tracks, as called for by the Missouri Public Service Commission regulations. No excess space being available for rearrangement of tracks, it was necessary to consider a reduction in number of spans with possible rearrangement of tracks. A two-span scheme with one intermediate pier solved the problem, but called for a slight reverse curve in one track. As the railway refused to approve this modification, it became necessary to adopt a single span of 335 ft.

The span adopted (Fig. 4) consists of two through trusses of Baltimore type, with subverticals and skew ends; the trusses are spaced 25 ft. 2 in. c. to c. and are 42 ft. high between working lines. Theoretically, a slightly greater height would have given more economical sections, but in view of the comparatively light sections of members required for the loading it was considered that a greater height would impair the appearance of the structure. A 3-in. camber was provided at the center and the details of trusses and connections were worked out on this basis. Rigid portal frames and intermediate sway frames at panel points were made about 20 ft. deep, insuring lateral stiffness. The trusses have fixed bear-

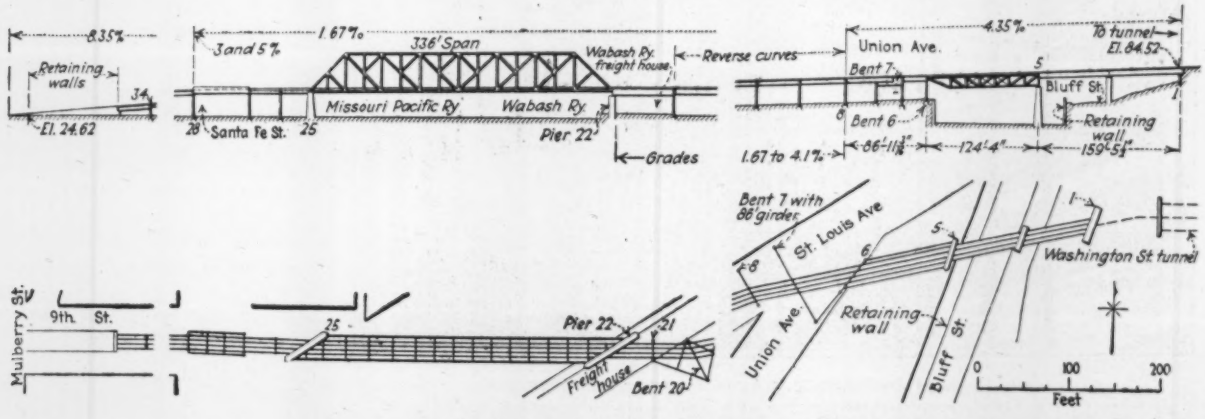


FIG. 2—PLAN AND ELEVATION OF NINTH ST. VIADUCT
Structure descends from tunnel to bottom lands of Kansas City's industrial district.

ings at the west pier and roller bearings at the east pier. A sharp skew of 30 deg. 40 min. at each end created special problems in design. This skew results in a spacing of panel points of equal deflection on opposite trusses 42 ft. 4½ in. apart longitudinally—that is, a floor beam connecting panel point 1 on the north truss with panel point 3 on the south truss frames into points of unequal stiffness and is necessarily subjected to a different amount of deflection at its two ends. This difference in deflections of opposite panel points varies from ¼ to ⅞ in. To provide a rigid connection of sufficient strength to develop a deformation of this magnitude at the ends of a floor beam would be out of the question. The writer, therefore, adopted pivoted connections for floor beams with end deflections in excess of $\frac{3}{16}$ in., as shown in Fig. 5. For less deflection, the gusset plate connections riveted to the verticals were made strong enough to develop the calculated deformation. Secondary stresses were taken into account and the corresponding calculated deflections at panel points allowed for. The gusset plates were bolted to allow for shock and adjustment during the initial loading of the structure. The end stringers have sliding ends on the masonry.

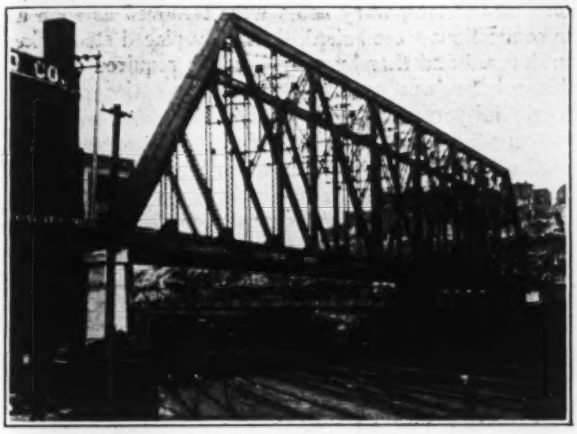


FIG. 4—THROUGH-TRUSS SPAN; 335 FT.
Ends skewed 30 deg. 40 min. Pier at right forms part of freight house wall. Rebuilt pier at left. Beyond is the footbridge shown in Fig. 1.

For this span the west support is an old pier of ashlar masonry, but the material increase in loading and tractive force, as well as the increased width imposed by the new 335-ft. span, called for an extension and strengthening of the old pier. This was carried out in the manner shown by Fig. 6. At the north end of the pier a reinforced-concrete incasing wall about 16 ft. long was constructed. A new cap along the top of the pier is formed monolithically with the new incasing wall and is reinforced to take care of direct loading and tractive forces. It will be seen that the footing of this new face wall extends for some distance under the old foundation, so as to engage the weight of the old pier and provide against uplift. At its south end the old pier was lengthened 15 ft. by a new concrete section which supports the south truss bearings. This extension is designed to afford a good tie into the old pier and make the structure continuous.

As the east end of this span is located directly over the west wall of the Wabash Railway freight house, the supporting pier is built to form a part of the wall and extends above the roof of the building. It consists of a series of reinforced-concrete columns so located as to avoid interference with the spacing of the doors and windows of the freight house. The columns are connected at top by means of a reinforced-concrete girder forming adequate seats for the bridge shoes and the end stringers.

West End of Viaduct—The remaining 420 ft. of the structure consists of a stringer and floor-beam system supported on steel bents, with spans varying from 35 to 48 ft. One span crossing Santa Fe St. and the Union Pacific Railway tracks is 60 ft. long, with 22 ft. headroom. The tracks are on tangent excepting for a small reverse curve at the east end. They have grades of 1.67, 3 and 5.07 per cent, the several grades being necessary to provide special overhead clearances demanded by adjoining property interests. All this part of the structure was on new foundations. Beyond it the tracks are carried to the street level on a solid fill, with a grade of 8.35 per cent, in a reinforced-concrete structure of U shape, consisting of a floor and retaining walls, with an abutment for the last steel span. On each side of this structure is a roadway 18½ ft. wide.

Station—A new station layout was provided on the 375-ft. rebuilt section, consisting of platforms 120 ft. long with a single stairway on the north side to a lower level platform. Access to the south platform is provided by a foot bridge suspended under the structure and giving ample clearance for the street beneath. The entire station structure is suspended or bracketed out from existing columns so as to avoid the use of new columns. Limitations of height and space necessitated special care in designing the framing to fit the existing work. On the upper or track platforms are umbrella roof shelters carried by canopy trusses on columns on floor beams below platform level. Industrial plants located on the opposite side of the Wabash Railway tracks are served by an existing foot bridge which connects with the lower platform. This structure, shown in Fig. 1, is owned by other interests.

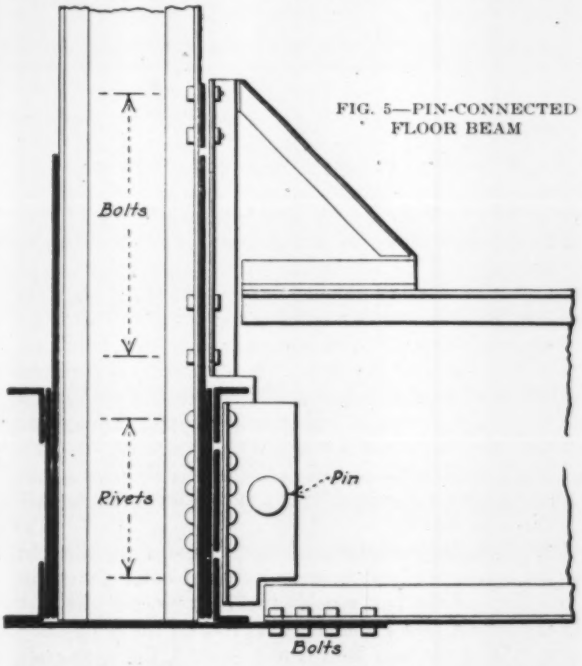


FIG. 5—PIN-CONNECTED FLOOR BEAM

Steel Erection—Except for the deck and through trusses the new material was hauled to the job by motor trucks and was erected with a steam whirley derrick

mounted on caterpillar tractors and rigged with a 20-ft. boom having a maximum load capacity of 10 tons. The 85-ft. girder at bent 7 was raised with the aid of an A-frame. For erecting the 120-ft. deck-truss span over the Kansas City Terminal Railway tracks, the old trusses were left in place. The majority of the old floor beams and bracing were cut out, leaving only sufficient to brace the old trusses. The new trusses, shipped by rail in three sections each, were raised from the flat cars and lashed to the outside of the old trusses, the east ends of the new trusses resting on pier 5 and the west ends

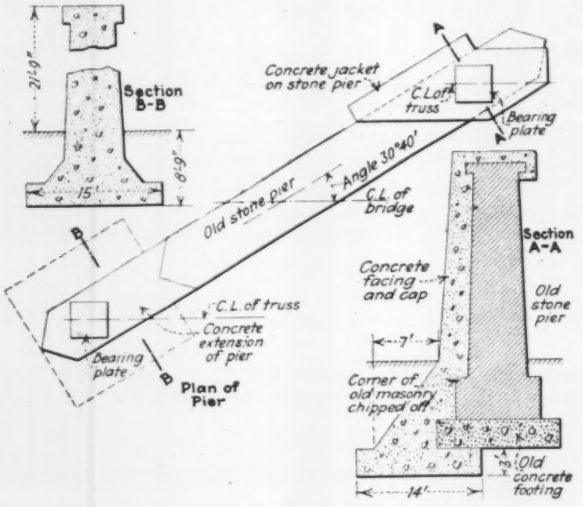


FIG. 6—ENLARGEMENT OF OLD BRIDGE PIER

supported on temporary wooden bents consisting of two 10x10-in. timbers set as an A-frame and tied to the old bent.

The entire work of raising these spans had to be carried on between regular train schedules and switching operations, which allowed approximately two hours of actual working time per day. These conditions required the use of an engine and crew during erection operations and made for unusually high erection costs. Power for hoisting was furnished by the whirley derrick, operating block and tackle rigging attached to the old structure. The latter equipment was moved to accommodate each section raised.

The west half sections of both trusses of the old structure and old bent 6 were removed after the main connections of the new trusses had been riveted, the east end resting on pier 5 and the west end on the temporary bents. After the new bent 6 was erected, the west ends of the new trusses were placed in position and the remainder of the old structure was removed piecemeal, being cut out in small pieces easily handled. During this process the new trusses were held in position and braced by lengths of old rails, fastened with U-bolts. After all of the old structure had been removed, the east ends of the new trusses were jacked into their final position.

Erection of the 335-ft. span was started at the west end. All material was shipped by rail and raised directly from cars. This method was accomplished by arranging for closing one track at a time. Only one crossover was required to carry out this method of erection. The cars were spotted where the material could be easily handled by a stiff-leg derrick with 90-ft. boom and a maximum load capacity of 25 tons. Power was furnished by a hoisting engine so arranged that the derrick could be moved without moving the engine.

Sections of the lower chords of the north and south trusses were picked up and set on pier 25 (see Fig. 2) and a temporary bent consisting of two 10x10-in. timbers was set as an A-frame under the panel points; the vertical members and floor beams were then set in and bolted in place. Successive lengths of the lower chords were then placed; the bracing, floor beams and portals were put in and the entire truss was built up. At a point approximately 80 ft. from the west pier a semi-permanent erection bent was located and the temporary bents were removed. The derrick was then moved up to this point and erection carried on as before, with the exception that the temporary bents were removed as soon as the connections were bolted, the newly placed steel being cantilevered and thereby providing the required camber. This process was carried out for the entire erection, three semi-permanent bents being placed.

Riveting was started after the derrick was moved ahead on the first section, and all main connections were full riveted. The top cross-bracing was placed as the derrick was moved up. The permanent bents were not removed until the structure was practically 100 per cent riveted. The temporary bents were so placed between tracks as not to interfere with traffic. The boom of the derrick was in 25-ft. sections and was shortened to place the east portal and the top cross-bracing for the last 40 ft. of the bridge. The boom was mounted on a pivot and could be swung 360 deg. To move the derrick, block and tackle were placed forward, rollers were placed under the derrick and it was pulled ahead by the donkey engine.

Personnel—The survey and design of this structure were under the direction of the William G. Woolfolk & Company, Inc., engineer and constructor, Chicago, Ill., with Ralph M. Yager, chief engineer, in general charge. The writer had direct charge of all structural design. The steel work was detailed, fabricated and furnished by the Kansas City Structural Steel Company, Kansas City, Kan. All erection and repairs for the old section were let to the Wisconsin Bridge & Iron Company, North Milwaukee, Wis.

Activities of Navy Civil Engineering Corps Tabulated for Fiscal Year

In an official report the Bureau of Yards and Docks of the Navy Department has tabulated the work done on contract plans and specifications in the fiscal year recently ended. There were 173 contracts awarded during the period. In addition, plans and specifications were prepared and bids solicited for 24 other projects. All of these projects represent a money value of approximately $6,019,000.

Plans and specifications are now in preparation for additional projects involving an expenditure of $4,270,000. Surveys and studies are also being made for the preparation of plans and specifications for work amounting to $4,700,000 for which appropriations are now available.

Aside from this contract work, the Civil Engineer Corps of the Navy has jurisdiction over the expenditure of about $12,000,000 a year for routine maintenance and operating activities at the various navy yards and stations, and for the civil governments of Guam, Samoa, the Virgin Islands and Haiti.

Study of Record Rainstorm at Louisville, Ky.

All Previous Records Exceeded at Some Local Gages With Considerable Variation Over Relatively Small Area

By Woolsey M. Caye
Technical Engineer, Commissioners of Sewerage, Louisville, Ky.

THE most intense rainfall ever recorded at Louisville, Ky., for the 31 years for which records are available, occurred on June 29, 1928, between 2:15 and 3 a.m., the rate being 4.68 in. per hour at the 30-minute duration period compared with the maximum of 3.44 in. per hour recorded on the U. S. Weather Bureau gage during its 31-year record. The total precipitation for the 24 hours ended at 7 a.m., recorded on the same gage, was 4.30 in., against 1.42 in. on U. S. Weather Bureau gage. This storm extended over the whole of the city, but the greatest total fall and intensity appear to have occurred over only the eastern and southern sections of the city, located some 2½ miles southeast of the U. S. Weather Bureau station and gage. The intense precipitation was recorded by three gages maintained by the Commissioners of Sewerage of Louisville and a gage of the U. S. Air Service.

The record for the intense portion of this storm and the larger number of the data given in this article were obtained from eight rain gages owned and maintained by the Commissioners of Sewerage. These gages consist of six standard rain and snow gages of the U. S. Weather Bureau pattern which have been recording rainfall since November, 1926; one tipping bucket electrical recording gage, U. S. Weather Bureau pattern, which has been maintained since August, 1927, and one rain gage similar to the standard gage, constructed by the commission, which has been calibrated to give correct readings. This gage was placed in the field in April, 1928. The locations of the gages already mentioned and of two others, the records of which are here considered, are shown by the map Fig. 1. The figures opposite each gage show the total rainfall in inches which fell during the 24-hour period from 7 a.m., June 28, to 7 a.m., June 29. As recorded by the commission's tipping bucket gage No. 7, the rain began at 8 a.m., June 28, and no more rainfall occurred during this 24-hour period after 3:06 a.m., June 29. A study of the various gage records show the intense portion of the storm to have passed along a southwesterly-northeasterly line, the closest point of which is 3 to 3½ miles southeast of the U. S. Weather Bureau gage. However, the path of storm passed over or just southeast of commission gages Nos. 4, 7 and 6 and the U. S. Air Service gage at Bowman Field.

Table I gives the rainfall of June 28-29 as recorded by the various commission gages, U. S. Air Service gage and the U. S. Engineer Corps gage, and compares these records with the U. S. Weather Bureau gage. Also is shown therein the elevation of the gages with distances other gages are below Weather Bureau gages. The figures contained in this table also show the total precipitation for the storm of June 28-29, as recorded by the commission gages and the Bowman Field gage to have been from 19.8 to 236 per cent greater than the rainfall as recorded by the U. S. Weather Bureau gage for the same period. Additional data given in this table, according to records and observations of commission gages, lead to the conclusion that from 46.5 to 83.3 per cent of the total rainfall of June 28-29 fell most probably during the early hours of the morning of June 29. The commission's tipping bucket gage No. 7 records 83.3 per cent of the total 24-hour precipitation as having occurred between 2:15 and 3 a.m. of this June 29, whereas during this same period the U. S. Weather Bureau gage recorded 0.44 in., being only 31 per cent of the total rainfall (1.42 in.) as recorded by that station and less than one-eighth of what was recorded by the commission's gage No. 7 for this period.

On the map (Fig. 1) is shown interpolated isopluvials or lines passing through certain probable points of equal rainfall, also wind directions, as recorded by the U. S. Weather Bureau. When comparing the probable direction and path taken by the center of the storm with the prevailing wind direction, it appears that the prevailing winds controlled the direction of this storm center and no doubt controlled the amount and intensity. This agrees with other observations of the commission and with other data in its files.

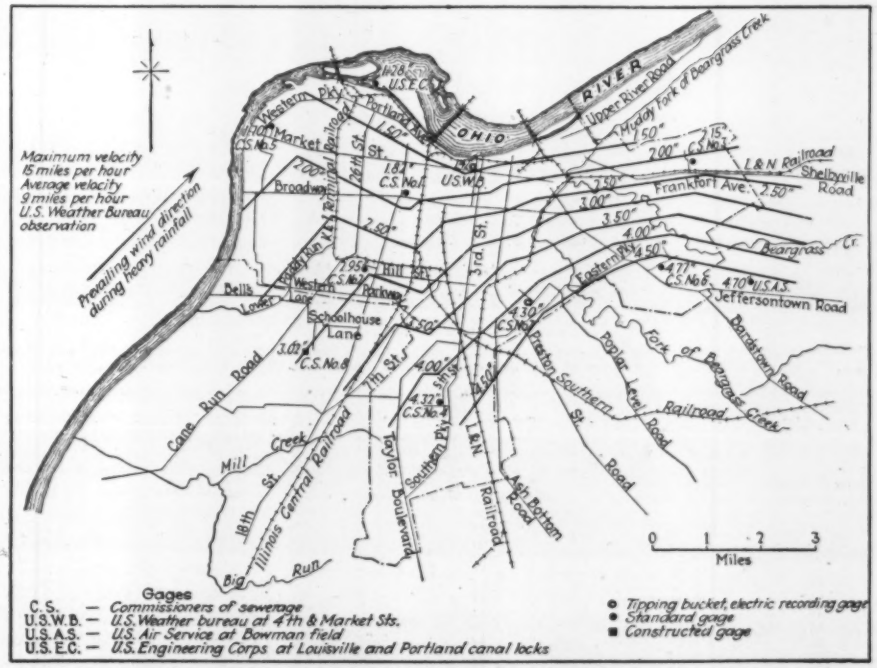


FIG. 1—LOCATION OF ELEVEN RAIN GAGES AT LOUISVILLE, KY., RECORDING STORM OF JUNE 28-29, 1928
Record for 24 hours, 7 a.m. to 7 a.m.

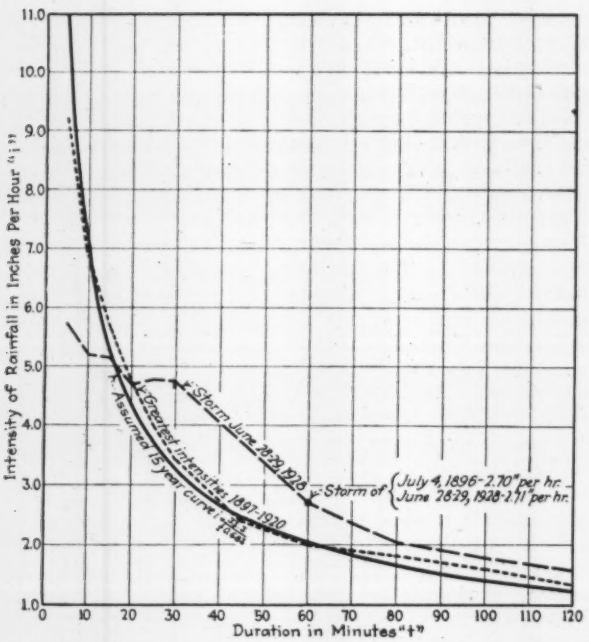

Intensity of Rainfall in Inches Per Hour "i"
Duration in Minutes "t"
Storm June 28-29, 1928
Storm of July 4, 1896-2.70" per hr.
June 28-29, 1928-2.71" per hr.
Greatest Intensities 1897-1920
Assumed 15 year curve 1897-1920

FIG. 2—RAINFALL CURVES AT LOUISVILLE, KY., JUNE 28-29, 1928 COMPARED WITH OTHER LOCAL CURVES

Intensities of this storm of June 28-29, from which the conclusion was reached that this storm stands first in order for storms recorded at Louisville for the past 31 years, are shown in Table II, for various periods or durations of from 5 to 120 minutes at various intervals. For comparison, Table II also gives Louisville rainfall data from 31 years of rainfall records of the U. S. Weather Bureau. The intensities (column 2) are obtained from an assumed fifteen-year storm or rainfall curve which forms the basis of estimating runoff for which sewers are designed by the Louisville Commissioners of Sewerage. This rainfall curve was obtained from a 24-hour rainfall record of the Weather Bureau from 1897 to 1920 inclusive.

In column 3 of Table II there are shown the greatest intensities of precipitation obtainable from the 31-year rainfall record, 1897 to 1927 inclusive. These rates or intensities were obtained from three separate and distinct storms occurring in 1898, 1917 and 1919. The intensities for the shorter periods were obtained from storms occurring in August, 1917, and July, 1919. The rates of precipitation for the longer periods, 60 to 120 minutes, were the intensities occurring during the storm of August, 1898, which gave the higher rates for the longer periods but lower rates for the shorter periods.

The rates of precipitation, as computed from the commission's tipping bucket rain gage No. 7 for periods of duration of 5 to 120 minutes, during the storm of June 28-29, are given in column 4 of Table II. Comparing the storm of June 28-29 (column 4) with the assumed fifteen-year storm (column 2) it may be seen (column 5) that for the shorter or five- and ten-minute periods the June 28-29 storm is considerably less in intensity, being 48.2 and 24.4 per cent respectively below the rates obtained from the fifteen-year curve, whereas for the fifteen-minute period the storm of June 28-29 is about equal to the rate as given by the fifteen-year storm. For periods of 20 to 120 minutes the storm of June 28-29 exceeds the fifteen-year storm, ranging from 9.5 per cent above at twenty minutes to 44.4 per cent above at the 45-minute period and continuing thus above the fifteen-year curve to the 120-minute period, where it is 27.8 per cent greater.

A comparison of this June 28-29 storm (column 4,

TABLE I—HEAVY RAINFALL OF JUNE 28-29, 1928, AT LOUISVILLE, KY., AS RECORDED BY ELEVEN GAGES

One U. S. Weather Bureau gage; eight Commissioners of Sewerage gages; the U. S. Air Service gage and the U. S. Engineer Corps gage. The record extends from 7 a.m. June 28, to 7 a.m. June 29

Gage			Elevation Above Sea Level, Ft.	Distance Other Gages Are Below U. S. W. B. Gage, Ft.	Total Rainfall, In.	Per Cent Other Readings Vary From U. S. W. B. Gage	Fall During Intense Period (Morning of 6/29)		Per Cent Fall During Intense Period Is of Total Fall
Maintained By	No.	Kind of Gage					In.	Time	
U. S. Weather Bureau	..	Tipping bucket electric recording	649	0	1.42	0.0	0.44	2:15 a.m. to 3:00 a.m.	31.0
Commissioners of Sewerage	1	Standard U. S. W. B. pattern	462	187	1.82	+ 28.2	....	.....	No record
Commissioners of Sewerage	2	Standard U. S. W. B. pattern	465	184	2.95	+107.5	....	.....	No record
Commissioners of Sewerage	3	Standard U. S. W. B. pattern	550	99	2.15	+ 51.5	1.00	6:00 p.m. to 7:00 a.m.	46.5
Commissioners of Sewerage	4	Standard U. S. W. B. pattern	460	189	4.32	+204.0	3.32	6:00 p.m. to 7:00 a.m.	76.8
Commissioners of Sewerage	5	Standard U. S. W. B. pattern	465	184	1.70	+ 19.8	....	.....	No record
Commissioners of Sewerage	6	Standard U. S. W. B. pattern	560	89	4.77	+236.0	3.60	6:00 p.m. to 7:00 a.m.	75.5
Commissioners of Sewerage	7	Tipping bucket electric recording	497	152	4.30	+202.0	3.58	2:15 a.m. to 3:00 a.m.	83.3
Commissioners of Sewerage	8	Constructed	470	179	3.02	+113.0	....	.....	No record
U.S. Air Service at Bowman Field	..	Standard U. S. W. B. pattern	544	105	4.70	+231.0	....	.....	.....
U. S. Engineer Corps at Locks of L. & P. Canal	..	Standard U. S. W. B. pattern	...	...	1.28	— 10.0	....	.....	.....

Note: Where amounts of rainfall during intense period were obtained from records of standard gages, the gage recorder measured the rainfall the night before and at 7 a.m. the morning following and as very little rain fell after 3 a.m. June 29, the observations are accepted as tabulated.

TABLE II—COMPARISON OF RAINFALL RATES DURING INTENSE PERIOD OF STORM OF JUNE 28-29, 1928, WITH FIFTEEN-YEAR RAINFALL CURVE AND MAXIMUM 31-YEAR INTENSITIES

Period of Duration, Minutes (1)	Assumed 15-Year Curve or Storm Intensities, In. Per Hour (2)	Maximum Rainfall Rates Which Have Occurred at Louisville, 1897 to 1927 (31 Years) Intensities, In. Per Hour (3)	Storm of June 28-29, Commission's Gage No. 7 Intensities, In. Per Hour (4)	Per Cent Intensity of Storm of June 28-29 Is Less or Greater Than Fifteen-Year Storm (5)	Per Cent Intensity of Storm of June 28-29 Is Less or Greater Than Maximum 31-Year Rates (6)
5	11.10	9.24	5.76	—48.2	—37.7
10	6.91	6.90	5.22	—24.4	—24.3
15	5.23	5.60	5.20	0.0	— 7.2
20	4.30	4.77	4.71	+ 9.5	0.0
25	3.70	4.03	4.80	+29.7	+10.9
30	3.26	3.44	4.68	+42.3	+35.0
45	2.48	2.43	3.58	+44.4	+47.3
60	2.03	2.00	2.71	+33.5	+35.0
80	1.67	1.82	2.03	+21.6	+11.6
100	1.43	1.62	1.79	+25.1	+10.5
120	1.26	1.36	1.61	+27.8	+18.4

Table II) is made with the 31-year storm (column 3) in column 6 of this table. Here it is found the June 28-29 storm lies below the 31-year storm for the five-, ten- and fifteen-minute periods, being about equal at the twenty-minute period, and from there on to the 120-minute period the storm of June 28-29 rises in intensity above this 31-year storm, being 18.4 per cent above at the end of two hours, or the 120-minute period.

A graphic comparison of the fifteen-year rainfall curve, the 31-year curve or storm and the storm of June 28-29, 1928, is made in Fig. 2. Also there is plotted on this same figure at the 60-minute interval a storm marked "July 4, 1896," of which a complete record is not available. However, it is evident that this rain of July 4, 1896, was a very unusual storm, such records as are available showing an intensity at the 60-minute interval

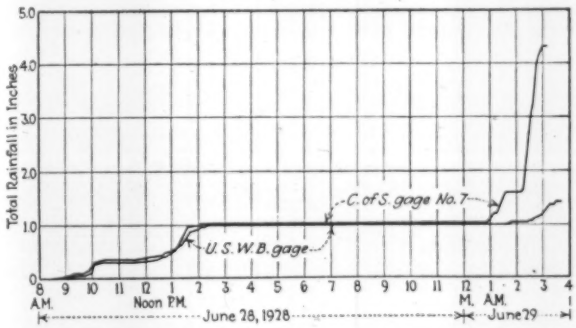

Total Rainfall in Inches
5.0
4.0
3.0
2.0
1.0
0
C. of S. gage No. 7
U. S. W. B. gage
8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4
A.M. Noon P.M. M. A.M.
June 28, 1928
June 29

FIG. 3—ACCUMULATED RAINFALL AT TWO LOUISVILLE GAGES, JUNE 28-29, 1928

The gages are those of the U. S. Weather Bureau and tipping bucket gage No. 7, Louisville Commissioners of Sewerage

of 2.70 in. per hour. Noting the curve for the June 28-29 storm, we find it passes through the point fixed by the storm of July 4, 1896. Referring to Table II, an intensity of 2.71 in. per hour is given for the storm of June 28-29 for 60 minutes' duration, which at least equals the storm of July 4, 1896.

Fig. 3 shows the plotted, accumulated amounts of rainfall, as recorded by the U. S. Weather Bureau gage and the commission's tipping bucket gage No. 7, that occurred during June 28 and 29, 1928. From this figure it appears that the rainfall was very nearly equal at these two stations until about 1 a.m., June 29, when the heavy precipitation began in the vicinity of the commission's gage No. 7, stopping at 3:06 a.m., whereas the rainfall in the vicinity of the Weather Bureau gage continued until 3:35 a.m. but at considerably less intensity.

The intense period of the rain of June 28-29, as recorded by the commission's gage No. 7, was preceded by a rather gradual precipitation (see Fig. 3). At 8:45 a.m. on the 28th the rain had begun, but only 0.32 in. had fallen by noon. Shortly after noon the precipitation increased until at 2:05 p.m. of the 28th 1.01 in. had fallen. From then until 12:55 a.m. of the 29th very little rain fell until 2:10 a.m., when he total rainfall amounted to 1:58 in. Shortly after, or at 2:15 a.m., the downpour began. It continued until 3 a.m., stopping rather abruptly at 3:06 with a total accumulated amount of 4.30 in. for the 24 hours ended at 7 a.m., June 29. In comparison, the U. S. Weather Bureau gage record shows that at 9 a.m., June 28, the rain had begun and at noon of that day only 0.37 in. had fallen. Shortly thereafter there was a slight increase in intensity, lasting until 2:20 p.m., the accumulated amount being 0.98 in. Precipitation then stopped, not beginning again until 1:30 a.m., June 29, and continuing until 3:35 a.m. with a total accumulated amount of 1.42 in.

That intensities higher than those here discussed probably occurred during this storm is indicated by the reading of 4.77 in. on the commission's standard gage No. 6 and 4.7 in. recorded by the U. S. Air Service Standard gage, which amounts are 11 and 9 per cent above the 24-hour total of 4.30 in. recorded by the commission's tipping bucket gage.

This rain, by reason of its intensity and on account of the intense period being preceded by the lighter precipitation, caused damage of greater and lesser extent in various sections of the city. Certain sections of the city served by sewers were seriously flooded. In sections without sewers large areas were covered with water, completely surrounding residences and buildings and floodirg numerous basements. Sewer construction now being done under direction of this commission was completely flooded out. The greater losses reported were from eastern and southern sections. These were washing out of a park bridge, the flooding of a public garage in which twelve automobiles of expensive make were almost completely submerged, the flood water rising to within 18 in. of their tops. Other damages were the flooding of corner stores and neighborhood shops, stoppage of street-car and other traffic at underpasses and other low points in streets and boulevards, and injury to roadways where flood waters passed over them at high velocity. The central or business section of the city appears to have escaped damage from flooding, most probably due to its being out of the area of heavy precipitation and also due to recent relief work done by this commission.

Two Cities Held Liable for Pollution of Water by Sewage

THE Supreme courts of the States of Oklahoma and Missouri have each held a city liable for pollution of water to the injury of private property owners, in each case notwithstanding pleas that the city was exercising a government function.

In City of Enid vs. Brooks, 269 P. 241, decided July 24, 1928, the court, on appeal, upheld a jury decision that the city had been negligent in operating septic tanks located about a mile above a dairy farm, it being alleged that the pollution necessitated abandonment of the dairy. A plea that the city was exercising a governmental function was held invalid, the court declaring "that the city is liable to a riparian owner for damages sustained by reason of the negligent operation of a municipal sewer system by its officers and agents.

In Windle et ux. vs. City of Springfield, Mo., 8 S.W. (2d) 61, decided June 21, 1928, the court upheld a jury decision and judgment based on alleged damages through pollution of a spring and lake due to percolation from a sewer installed for the city by a contractor. The higher court said, in part: "If a sewer, whatever its plan or the conditions under which it was installed, is so conducted as to cause a positive and direct invasion of the plaintiff's property by percolating the soil in such a manner as to contaminate the owner's water to such an extent as to render it unfit for use, then the city may be held liable in an action for damages arising from such injury."

Further details of both decisions are given in *Public Health Abstracts* (U. S. P. H. Service, Washington, D. C.) for Sept. 21, 1928.

Home-Made Power Maintainer for Gravel and Stone Roads

Outfits Costing Only $400 Each Produced From Old Motor Trucks and Wood-Frame Drags Made in County Shops

By Ben H. Petty

Assistant Professor of Highway Engineering, Purdue University, Lafayette, Ind.

TO KEEP gravel or stone road surfaces in condition under heavy motor-vehicle traffic they must be worked over frequently with a long-base heavy drag or maintainer. County and township highway officials are, therefore, rapidly equipping their maintenance forces with some of the very excellent types of heavy road maintainers now on the market. Others, lacking adequate funds, have resorted to the use of home-made equipment.

A unique example of these devices has been developed by John Miller, Tippecanoe County highway superintendent, at Lafayette, Ind. With his very able mechanic, O. W. Stevens, he has constructed the surface maintenance outfit shown in the accompanying illustrations.

The drag proper consists of a long, heavy frame to which are attached three sets of V-shaped cutting blades which alternately move the loose metal in to the center of the drag, then out and then in, the excess being finally distributed in a smooth layer by a diagonal blade across the rear. The first drags were made of steel, using 9-in. I-beams, but the frequent fractures, resulting evidently from the excessive vibration, brought about the use of timber in the later models. A total of 208 ft. b.m. is required and 4x6-in. timbers are used throughout. The steel cutting blades cost $22. The entire cost of the drag, including labor, is $100.

For power units, old 1½- to 2½-ton trucks were purchased from local garages for from $50 to $150 each.

FIG. 1—RAISING AND LOWERING DEVICE ON HOME-MADE DRAG

These trucks were overhauled and the necessary repairs made at a cost of $100 to $150 per truck. The motor blocks were reground and oversize pistons were installed. Air cleaners were also placed on the motors to counteract the effects of the excessive dust when dragging.

To assemble the outfit the truck body is removed, the truck is backed into the drag and the latter is hung to the chassis by ½-in. steel cables or chains. The lifting device used is illustrated by Fig. 1. Steering gear from old trucks, as well as the raising and lowering device from old farm self-binders, has been used satisfactorily. Inclosed steering gear of the worm and worm-wheel type, which permits turning through the entire 360 deg., is used on the outfits now being built. This gear is inclosed and there is less wear and tear due to dust. The levers are extended to the left side of the cab, where they are convenient to the driver.

On each side heavy pulling chains lead from the chassis to both the rear and the front of the drag to pull it ahead or to permit backing up. To control side movement, four ½x8x18-in. steel plates are attached to the side frame of the drag in such positions that they come in contact with the rear hubs and the extension plates on the truck steps. Some play is allowed here to avoid continual friction. (Fig. 2.)

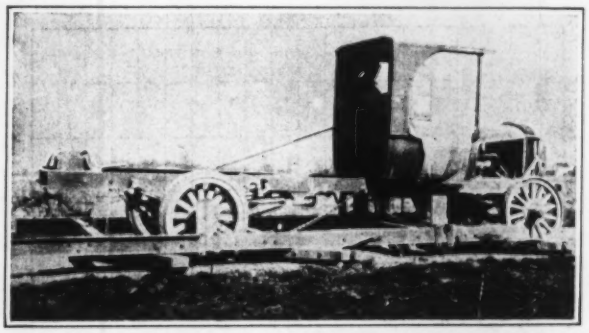


FIG. 2—PULLING CHAINS AND GUIDE PLATES ON HOME-MADE DRAG

Eight of these outfits are now in operation and the plan is to continue their manufacture until sufficient units are available to cover the entire county road system. This will eliminate horse-drawn equipment entirely, thereby reducing the number of sub-districts from 26 to 12. The smaller maintenance organization of full-time men will be much more efficient then the original large group of part-time men.

One of these units will cover from 40 to 50 miles per day, equaling a round trip to 20 to 25 miles of road. The driver is paid $4 per day. About 15 gal. of gasoline and ½ gal. of oil are consumed per day at a cost of approximately $3. Considering the very low depreciation due to the small investment (averaging about $400) and the reasonable tire and repair costs, it is safe to say that the total cost per day in using this outfit would not exceed $10. This would figure approximately 25c. per mile, or 50c. per round-trip mile. One outfit has been operating practically continuously for 21 months and three others for seven months with no major repairs.

The writer has observed the maintenance work in this county and can testify to a remarkable improvement on the roads where these outfits have been operating for a reasonable length of time. Obviously success depends to a great extent upon the ability of the mechanic in building the drags and selecting and overhauling the power units.

Low Typhoid Death Rate in Summer of 1928

Typhoid fever cases for the eight weeks, July 1 to Aug. 25, 1928, reported to the U. S. Public Health Service by 41 states, totaled 5,821, against 7,690 for the same period and states in 1927, and 8,527 in 1926.

An Example of Modern Building Planning

Twelve-Story Auto Sales Building in New York City a Result of Business Analysis of Real Estate Trends Tempered With Engineering Judgment—Structural Details

By W. W. Hay
Building Engineer, New York City

A NEW twelve-story reinforced-concrete building with steel core columns, just occupied by the Uppercu-Cadillac Corporation, distributor of Cadillac and La Salle motor cars in the city of New York, is interesting not only because it is probably the tallest building yet erected solely for use as an automobile sales and service building but because it is a notable example of good real estate development.

That corporation is indeed fortunate when, in the nature and growth of its business and in the character and training of its management, it is able to select a site, study the needs and arrangement of space and at the proper time crystallize its plans and bring the whole development to a successful conclusion. Almost twelve years ago the first plans were commenced on this project and the first plot of land was purchased. From its inception it has had the guidance of an engineer, and the result is a nice balance of the desires of business with the requirements of operations.

For some years the operations of this corporation in New York have been carried in in six separate buildings scattered throughout Manhattan, each of which was erected for a particular function as the need required. The successful sale and servicing of motor cars have brought upon the distributor an increasing number of burdens, and it was with the idea of reducing the cost of these demands and at the same time of giving the customers greater satisfaction in service that led to the construction of this building. Nevertheless, the actual construction was precipitated by a condition of comparatively recent growth, and that was the growing congestion of traffic within the metropolitan areas, which not only made it more difficult to reach the various buildings when desired but made the time consumed in getting there a matter of consequence.

FIG. 1—UPPERCU BUILDING, NEW YORK CITY
This twelve-story reinforced-concrete structure has been built expressly for motor car sales and service, but is designed for easy remodeling for other occupancy.

The new building will concentrate in one structure the administration and office forces, sales force, display of new and used cars, service and repair of cars, body and coach work and storage of new and used cars. The requisite of location for service and repairs is accessibility; for sales is prominence; and for any real estate is enhancement in value. Having these requirements, a plot of land occupying a block front on Columbus Ave. between 62nd and 63rd Sts. was assembled. This location, between eastbound and westbound streets and on a north-and-south thoroughfare, centrally located, is accessible from any direction. It overlooks Lincoln Square, a triangular space formed by Broadway, which is a diagonal street, and thus has the prominence of more expensive frontage on Broadway. And the present activity and future promise of real estate in the vicinity have already led to considerable increase in the value of the land.

It would have been possible to select a piece of ground farther west at considerable saving in cost, but a building erected there would have had no more market value than its neighbors—garages, warehouses, service stations and tenements. In its present location the building has an increasing value for commercial purposes, as its neighbors prove; the consideration of its possible future use for offices, as a department store, as parking garage or at worst as loft space, influenced many details of the design. That this forethought on the part of the owners is shared by others has been demonstrated by numerous offers on the part of professional real estate operators to purchase the property and give back a lease of comparatively short term.

Having in mind, then, the various occupancies that might develop in the future, the building was made to comply with bylaws affecting such usage, the column spacing was increased and the panels made square, the column diameters were kept to a maximum diameter of 32 in. and the live load was increased to 120 lb. per sq.ft. In addition, the mezzanine floor was so constructed that it can be removed without difficulty, and the large freight elevators are designed to be converted into passenger elevators at small expense other than cages and doors. The building is strictly fireproof in the accepted sense, with fire protection provided by automatic sprinklers, with gravity and pump water service, electric fire alarms and other devices. The arrangement and space requirements were based on the experience in operating the business over a long period of years and are the result of constant study with this end in view. In addition, one entire floor of open storage space has been provided as overflow in handling cars, whether it might be for service, dead storage or merely temporary storage.

The building covers the entire plot of ground, 200 ft. 10 in. on Columbus Ave. and 125 ft. on both side streets.

It is twelve stories in height, with basement and sub-basement. The first floor has a story height of 24 ft. 5 in. and the mezzanine is in effect another floor in size. The construction is reinforced concrete, with flat slab floors, carried on structural steel columns in the lower floors, and the whole is faced with tapestry brick above the third floor. The two street floors are faced with limestone, resting on a granite base and water-table, and the topmost story and the parapet are trimmed with concrete and terra cotta ornaments. Windows on the three street elevations are double-hung, of solid steel sections, with slate sills, while factory-type steel sash is used on the lot line elevation above the second floor. Asphalt roofing is laid directly on the roof slab and

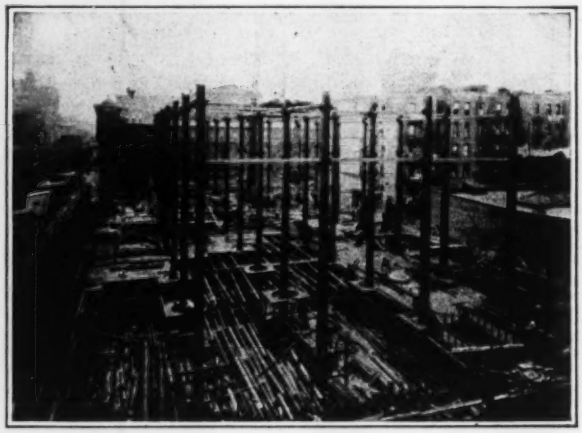


FIG. 2—FIRST LIFT OF STEEL COLUMN CORES
Note temporary bracing system near tops.

covered with 6x9-in. quarry tile in a 1:6 mortarbed for wearing surface on the main roof and crushed slag for the remainder of the roof areas. All the flashing and gutters are of 16-oz. copper throughout.

All cars for service and repairs are received in the basement, which is reached by 10-ft. wide ramps from either side street. Cars are delivered to the various floors by one of four large elevators of 8,000-lb. capacity; two of these deliver direct to the outside street doors from any floor, and two run to the roof, used for parking and testing. On the first floor, at street level, are offices, showrooms for both used and new cars and waiting rooms and toilets for owners and for chauffeurs, as well as a large open space for quick repairs and adjustments. All salesmen are provided for on the mezzanine, overlooking the showrooms. All administration offices are on the second floor, surrounding a space 50x175 ft. used for demonstration. The upper floors are then allocated as follows: floor 3, new car delivery; floor 4, new car storage; floor 5, open (overload) storage; floor 6, used car storage; floor 7, parts department and retail sales; floors 8, 9 and 10, service and repair departments; floor 11, coach work, and floor 12, body department. It is to be noted that the lower floors, which are most likely to suffer loss of light on account of future buildings on the adjoining land, are devoted to storage of cars.

Many considerations affected the adoption of reinforced-concrete construction for this building. In any building used for garage purposes the wearing and cleaning qualities of the floors are of first interest. The cheapest floor which fulfills both structural requirements and surface-wearing qualities is the concrete floor. By the use of flat-slab floor construction there is a clear saving of 1 ft. in the story heights, which when cumulated permitted the construction of the required number of floors in this building without the use of a setback. This consideration in itself was sufficient to outweigh all others but in addition it has been estimated by the owners that there has been a money saving of about $1,700 per typical floor through the use of square panels and flat ceilings, which permitted simplified lighting layouts, a cheaper sprinkler installation, fewer painted surfaces, better distribution of natural light and anticipated savings in future maintenance. The floor slabs were finished monolithic throughout above the third floor and were afterward treated with a surface filler to prevent any dusting and to render the surface oilproof.

Until recent years there has always been a serious objection to the use of reinforced-concrete construction in buildings higher than six or seven stories, because of the rapid enlargement of the column shaft in the lower floors. The use of structural steel columns with reinforced-concrete floor systems has removed this objection, and in this building all of the interior columns below the sixth floor are structural steel. The building code of New York permits the use of such steel columns when designed to carry the entire loading; it permits the use of 16,000 lb. per sq.in. on the steel cross-section for ordinary story heights and requires full fireproofing of 4 in. of concrete outside the extreme dimensions, the fireproofing being reinforced with ½ per cent horizontal and vertical steel.

With the live-load reduction permitted, a minimum shaft diameter of 2 ft. 10 in. was secured. The steel columns are all 14-in. H-sections, the areas being increased by the addition of plates riveted to the flanges, although in some cases plates are riveted to the web. The steel columns rest on heavy steel billets, milled to bearing. The billets are proportioned for a bearing of 750 lb. per sq.in. on the supporting concrete, which is reinforced by a spiral; the bearing of the concrete base on solid rock is 500 lb. per sq.in. The top of the

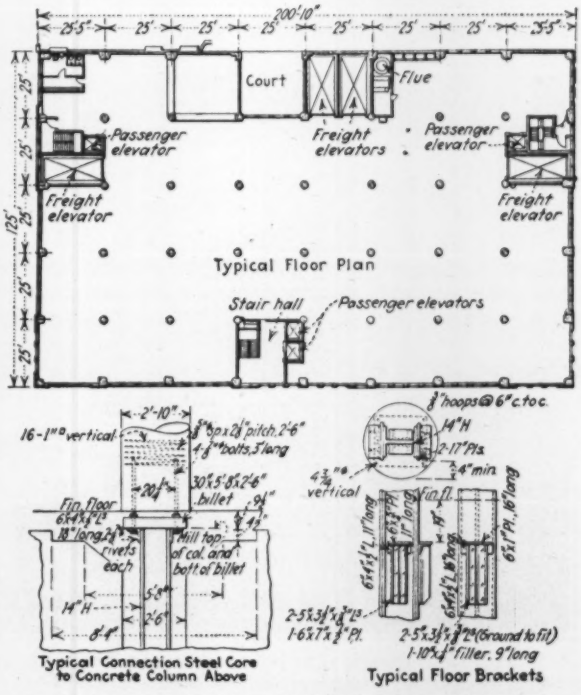


FIG. 3—TYPICAL FLOOR PLAN AND COLUMN DETAILS UPPERCU BUILDING

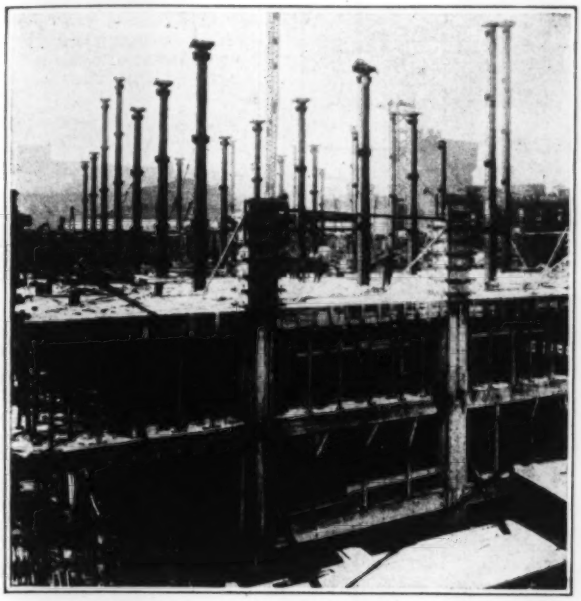


FIG. 4—BILLET STEEL SLABS USED ON TOP OF COLUMN CORES TO SUPPORT BAR REINFORCED-CONCRETE COLUMNS ABOVE

structural steel shaft is likewise capped with a steel billet, designed to transmit the inverted load on the column below. The shear at each floor is transmitted to the steel column by seat brackets on the four faces of the H-column.

The structural steel columns, 28 in number, are generally seven stories in length and were erected in two lifts. The splices are all at the fourth floor, nineteen columns stopping at the sixth floor, seven at the seventh floor and two at the eighth floor level. The use of steel shafts four stories high eliminated the practical objection to keeping a structural steel erection gang on hand and idle while each floor was being poured. The column sections were so arranged with properly designed top bracing to take the place of the floor system that the erection gang could erect and brace the first lift and then leave for another erection job until the several floors were concreted.

There is about 350,000 sq.ft. of floor space in this building, not including the roof area available for overflow storage and brake testing, and about 4,400,000 cu.ft. The building will accommodate 1,000 automobiles and 400 employees. The total investment will be nearly $2,500,000, partly financed by a first mortgage loan of $1,700,000. The architect is Charles E. Birge, of New York, and the entire construction was carried out by the Turner Construction Company, New York City, under the direction of M. J. Roach. M. L. Fouquet, vice-president, was in charge for the owners and was responsible for the development and planning of the project, assisted by J. A. Rowe, the company's engineer.

Tall Reinforced-Concrete Building—Correction

In an article in *Engineering News-Record* of Aug. 30, 1928, by Benjamin B. Shapiro, entitled "Tall Reinforced-Concrete Building Involves Special Design," the number of tons of structural steel called for in the building was stated on p. 317 as 509 tons. This was an error. It should have read 905 tons.

Capping Structural Steel Cores in Reinforced-Concrete Columns

Four Methods of Connecting Steel-Core Columns to Upper Story Columns of Reinforced Concrete

By R. C. Reese

Consulting Engineer for the Building Products Company, Toledo, Ohio

In an Article in the July 19, 1928, issue of this journal, on p. 88, Frank A. Randall, structural engineer, Chicago, described the use of structural steel cores in the columns of a 22-story reinforced-concrete apartment building, known as the 1400 Lake Shore Drive Apartments, in Chicago. Mr. Reese, the author of this article, fears that the details used in this Chicago apartment were extremely light, particularly the cap detail on the structural steel core. Mr. Reese has made it a practice of designing the cap as an inverted base, making the plates, stiffener angles, etc., competent to carry the bending. He gives in this article several examples from his current practice.
—Editor.

In reinforced-concrete columns using structural steel cores there are in general four ways of transmitting the load from the concrete column above to the steel core beneath: (1) By a light cap plate properly supported by wing plates, bracket angles and stiffeners to take the bending; (2) by milling the top of the column and providing a heavy rolled steel slab sufficient in itself to carry the bending; (3) by a combination of these two methods, using a moderately heavy slab to take part of the bending and a fairly heavy shelf angle to take the remainder; (4) by using a light cap detail and depending upon the concrete fireproofing of the core below to transmit the load or at least a considerable part of it. It is felt that this last method is not as positive or as satisfactory structurally as any one of the first three methods.

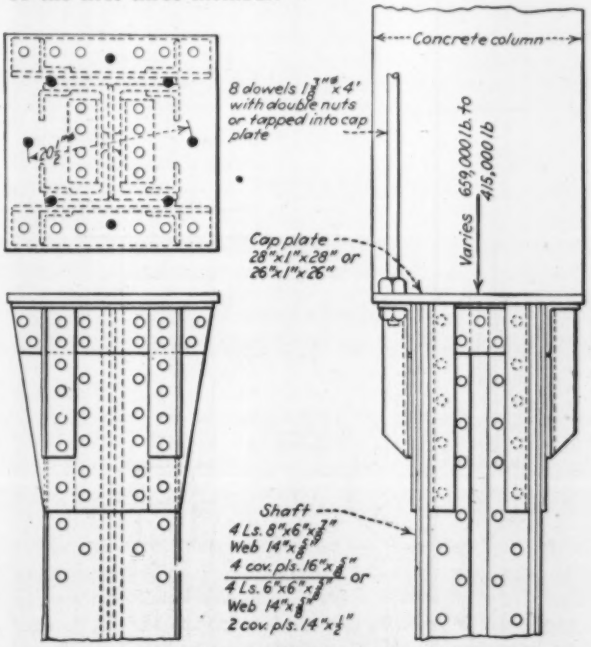


FIG. 1—CORE CAPS OF STIFFENER ANGLES AND LIGHT TOP PLATE

As an example of the first method, there is shown in Fig. 1 a detail of the column cores for the Home Bank of Toledo, of which Walker & Weeks, of Cleveland, were the architects. This detail was of built-up plate and angle columns constructed in 1923, when H-sections were not as readily obtainable as they are at present. The 26x26x1-in. cap plate is supported by wing plates and stiffener angles so that it takes relatively small bending and can therefore be quite light. The entire reaction is figured as passing into the steel shaft through the rivets. Adequate dowels were provided to develop the vertical rods in the shaft above. The idea of milling the column verticals to bear on the cap plate was rejected in the belief that the bond stress would develop the verticals into the dowel rods. The building is nine floors and a roof, with steel cores used up to the second floor line. Steel cores were selected not so much to keep the column size small as because the banking room was spanned by steel trusses and it was considered better practice to support these trusses on steel columns.

In the construction of the Lamson Brothers department store at Toledo, rolled steel slabs were set on the milled surface of the column core as shown in Fig. 2. Light connection angles were provided for attachment, but did not assist in supporting the slab. The vertical steel from the shaft above was developed into dowel rods as shown. Welded steel hoops were provided in place of spiral hooping. As shown in Fig. 2, the dowel bars are supported on brackets with stiffener angles designed to carry the total stress in the verticals, so that the cap plate has only to take the load in the concrete core. The maximum column reaction on top of the cap plate was 720,000 lb., in which case a slab 48x30x6 in. was used. The average reaction was about 600,000 lb. The building is at present six stories high, designed for two additional future stories of relatively heavy construction. The steel cores were used on this building in order to accommodate in the hollows of the steel H-column two 8x10-in. vent ducts for the ventilating system. Mills, Rhines, Bellman & Nordhoff were the architects.

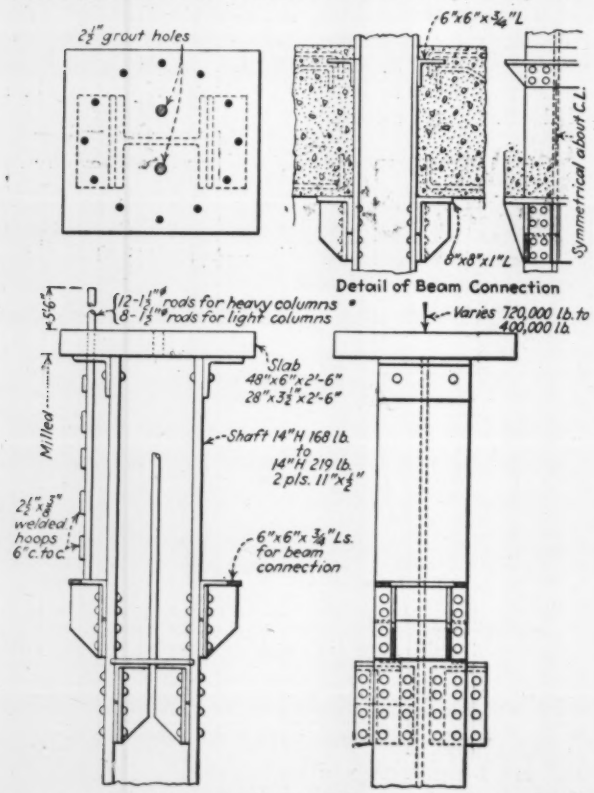

2½" grout holes
6"x6"x¾"L
Symmetrical about C.L.
8"x8"x1"L
Detail of Beam Connection
12-1⅛" rods for heavy columns
8-1½" rods for light columns
Varies 720,000 lb. to 400,000 lb.
Slab 48"x6"x2'-6" 28"x3½"x2'-6"
Shaft 14"H 168 lb. to 14"H 219 lb. 2 pls. 11"x½"
Milled
2½"x⅜" welded hoops 6" c. to c.
6"x6"x¾" Ls. for beam connection

FIG. 2—CORE CAPS OF STEEL SLABS ON MILLED COLUMNS

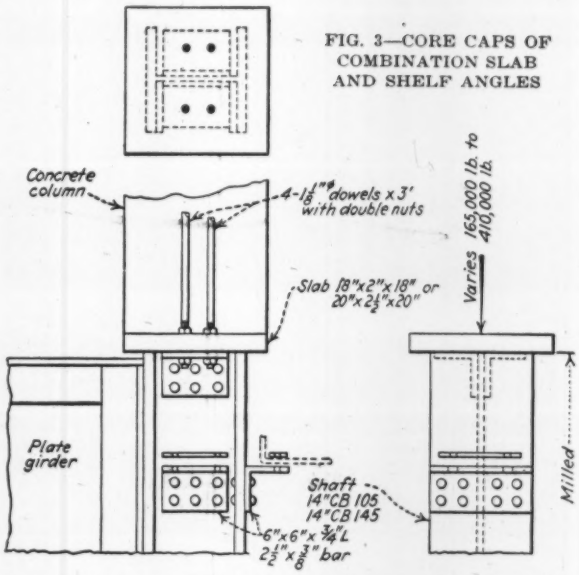


FIG. 3—CORE CAPS OF COMBINATION SLAB AND SHELF ANGLES

The third type of construction, illustrated in Fig. 3, is used on the Community Hotel, Charleston, W. Va. Rolled steel slabs took the majority of the bending from the load above, supplemented by 6x6x¾-in. shelf angles. Dowel rods as in the first case were developed into the cap plate and not into the column shaft direct. The maximum column reaction was 410,000 lb. and a slab 20x20x2½ in. was used. The other column reactions varied from 165,000 to 280,000 lb., in which cases slabs about 18x18x2 in. were used. The steel cores framed into plate girders spanning the dining room, ballroom, etc., and although the steel cores were somewhat more expensive than straight reinforced-concrete columns, they were selected because it seemed better practice to make a rigid steel frame than to set the girders loosely on concrete columns. W. L. Stoddart was the architect, and the writer prepared the structural design. On all the buildings the Building Products Company was fabricator and designer of the reinforcing steel.

The fourth method seems somewhat questionable in its action and has never been used by the writer. If the core below is incased in 2 or 3 in. of stone concrete, it is quite possible that some light lug angles riveted to the shaft at random to assist the bond stress would be sufficient to transmit the load from the column above through the fireproofing and into the lower shaft.

In Figs. 2 and 3 are shown details of the beam supports. In Fig. 2 the floorbeams are designed as simple concrete beams with the bottom bars hooked for bond, the truss bars also hooked and additional U-shaped top bars provided for anchorage into angles securely riveted to the steel core. In Fig. 3 the bottom reinforcing bars were supported by steel shelf angles and were securely hooked around flat bars to provide a definite anchorage. Truss bars were hooked into holes provided for the purpose in the top angles. In this case also the beams supported by the steel cores were designed as simple spans. Our present feeling is that such beams should be treated as simple and not as continuous beams, although the top steel should be anchored adequately to develop a negative moment of at least $Wl/16$.

Engineering Literature

A Monthly Review of Books and a Listing of New Publications

German Text on Water Supply

REVIEWED BY ABEL WOLMAN

Chief Engineer Maryland Department of Health, and Editor "Journal" American Water Works Association, Baltimore, Md.

HANDBUCH DER WASSERVERSONGUNG — Von Professor Erwin Gross, Abteilungsleiter der Landesaustalt für Wasser—Boden- und Lufthygiene in Berlin-Dahlem. Munich and Berlin: R. Oldenbourg. Cloth; 6x9 in.; pp. 427; 187 illustrations. 22 marks in Germany.

The principles and technology of water-supply development have been elaborated to such a degree in the past twenty years that it is doubtful whether any author can do justice to the entire system in as brief a discussion as one volume, aggregating as in this case some 400 pages of text. A bird's-eye view of a field of endeavor and a technical source book are not synonymous. The present volume suffers from the disabilities of any short handbook—namely, uneven balance of subject matter, omission of important principles and facts and compression of data within too limited space. In spite of these disabilities, the volume is surprisingly interesting and valuable in that it presents certain topics in a comprehensive manner and in a fashion not easily available in American texts. As in the case of most foreign texts, on the other hand, it consistently ignores American practice, even where the latter is helpful and perhaps more advanced than the foreign, as, for example, in the carefully developed programs of chlorination control in the United States.

The author has attempted to cover the field of water supply by discussing basic principles of selection of source, development of underground and surface supplies, collection of water, treatment, and distribution and pumpage. Unusually excellent, though brief, discussion is given on the problem of predicting water consumption. The author recognizes a factor of importance, frequently ignored in the United States, and exemplified in his statement: "Water consumption is in an important degree a measure of the standard of living of the people." His data on per capita water consumptions in German cities are instructive.

Similarly helpful discussion is given of hydrogen-ion concentration, iron and manganese removal agressivity and aeration. As a matter of fact, these topics are more completely and carefully handled herein than in most water-supply texts. Instructive graphical methods are presented for determining aggressive CO_2 and for estimating the precipitation possibilities for iron and calcium in different chemical complexes. Other important phases of treatment are not so generally useful, although worth while for comparisons with American practice. The discussion of chlorination is inadequate, from the standpoints of general application, of control and of principles of reaction. The only free chlorine indicator mentioned is benzidine. Chloramine treatment receives four lines of discussion, while ozone is covered in three pages.

As usual in German texts, the question of underground water-supply development is handled at length and with much mathematical detail. These sections deserve careful review, because they contain a number of interesting suggestions on deep-well construction. Some of the types of well construction are reminiscent of that recently constructed at Amarillo, Tex., to provide for automatic gravel replacement of sand.

The sections on pumps and dams are necessarily too short to do more than present general principles. The reviewer doubts the wisdom of even including the subject of dams, for example, when earth dams are dismissed in less than ten pages.

In general typography the book is excellent. It is well illustrated and carefully indexed, and has an unusually good table of contents. A bibliography of 92 references is appended, of which two are published in the United States.

Development and Uses of Power Shovels

EXCAVATING MACHINERY AS REPRESENTED BY POWER SHOVELS, DRAGLINES AND GRABBING CRANES—By W. Barnes, M.I.Mech.E. London: Ernest Benn, Ltd. Cloth; 7x10 in.; pp. 247; 160 halftones and line cuts; 42s. net.

Although writing from a British standpoint, the author presents a very complete and unbiased history of the development of excavating machinery, giving much space to American manufacturers, both past and present, as well as those of his own country. The book opens with an interesting historical sketch, of which the following is a summary:

The earliest use of excavating machinery dates back to 1560 with the development of a dredge in England containing a crude wooden bucket operated by ropes and hand winches. The first successful steam shovel was developed by Otis in 1834 in the United States and was used in building the Baltimore & Ohio Railway, which was the first application of a power shovel. This early shovel, crude as it was, contained the fundamental principles which are maintained in our present highly developed machines. The machine was self-propelling on rails, had a slewing boom, a crowding dipper stick operated by chains from the main engine, a hoisting system very similar to that used today, and the bucket itself corresponded almost exactly to the modern bucket. In 1836, Eastwick & Sons, of Philadelphia, built four pioneer shovels, which fully demonstrated the practicability of power-excavating equipment and paved the way for future development. The first of these was used in the construction of the Boston & Albany Railway, the second and third ones constructed were sent to Russia under orders of the Russian government, and the fourth one was used in England in building the Eastern Counties Railway.

Power shovels were first built in England in 1874 by Dunbar and Ruston. These were an improvement over the old Otis type, and their rugged construction is indicated by the fact that many of the first ones built were in use more than 50 years. The name of Ruston is still connected with one of the largest present-day shovel manufacturers in England. In this same year, the first full-swing shovel came into being. Previous to this time, the turning principle was applied entirely to the boom, as in our railway-type shovels. The Manchester ship canal in England, started in 1887, was the first large

project to use excavating machinery on a large scale. Simultaneously with the English development of power shovels, Scotland and the United States were introducing many models, each an improvement over anything produced up to that time. From 1887 to 1900 many American manufacturers came into the field, notably the Oswego Company at Toledo and many others which are well known today, such as Osgood, Industrial, Marion and Bucyrus. The first power shovel to be taken off railroad trucks and put on wheels suitable for road transportation was made by the Vulcan Company in the United States in 1880. De Lesseps bought nine of the American-made Osgood shovels in 1882 for the construction of the Panama Canal.

All through this period many different types and details of operation were tried and discarded. Many machines had steam cylinders for the crowding action and some even had the steam cylinders for the slewing action. At first the booms were solid frames, and it was not until the close of the century that the crane boom as we know today on power shovels was developed.

The full-circle steam shovel, corresponding to our modern type in appearance, was developed in 1902 by the Ruston & Proctor Company in England. The pioneer full-circle shovel in America was developed by Thew in 1895 for loading ore at docks. This machine, while on tracks and wheels, but slightly resembled the machine we know today.

Early in the twentieth century other types of power excavating machinery were developed, notably the dragline. In 1904 the first dragline was operated from a stiff-leg derrick by J. W. Page, of Chicago. J. O. Heyworth was the first to apply the dragline to a full-circle derrick crane used in 1908 on the Chicago drainage canal.

Electricity was used as power for operating excavating equipment as far back as 1899, but up to 1914 only twenty machines had been so equipped. Likewise the application of internal combustion engines to power-excavating machinery was very slow. The Bucyrus Company turned out the first machine equipped with a gasoline engine in 1911, but as late as 1920 this type of power was not considered a success.

The foregoing summary of historical developments takes up but 40 of the 240 pages of the book, and the remainder of the book is devoted to a study of the present-day equipment, most of which has been developed since 1920. The next 50 pages discuss the different types of excavating machinery available, such as the full-circle shovel, the railway-type shovel, clamshell crane and draglines, with a study of the type of power used, such as steam, electric, internal-combustion engines and compressed air. A study of Chapter 3, on the constructional details of power shovels, will enable any one to understand their construction and operation down to the smallest detail.

Chapter 4 is perhaps the most useful part of the book, as it is an exhaustive study of the application of all kinds of power equipment. The author takes up this study from different fields, such as contracting, strip mining and quarrying and clay excavation for the brickmaker. Sound advice as to what type of machine to buy is given in Chapter 5, under "Hints for the Prospective Purchaser." This is followed by further advice to the user after acquiring a machine in a long chapter on "Hints for the User." This chapter is essentially a chart for the guidance in the proper care and use of any type machine, and the information given is both very appropriate and well presented.

The book closes with a chapter on auxiliary plant and its applications, which considers plant and methods incidental to the use of power excavating machinery, such as blasting, drilling and the use of haulage machinery. The use of 150 illustrations, most of them photographs, add much to the interest of the book.

The book should prove valuable to those desiring an accurate historical sketch of the development of excavating machinery, as well as the applications, possibilities and limits of working conditions as represented by the highly developed equipment available today. The fact that no construction job at the present time, however large or small, is undertaken without involving the use of some type of excavating machinery justifies the author in going into the details he has in presenting a complete history of his subject from the first crude machines to the present-day models.

Third Edition of Eckel's Cements

REVIEWED BY P. H. BATES
Chief, Silicate Division, U. S. Bureau of Standards, Washington, D. C.

CEMENTS, LIMES AND PLASTERS: Their Materials, Manufacture and Properties—By Edwin C. Eckel, C. E., Affiliate, Am. Soc. C. E., Fellow, Geological Society of America; formerly Major, Engineers, U.S.A. Third Edition, with Chapter on Alumina Cements and High-Strength Portlands. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 699; 162 illustrations; 269 tables. $7 net.

At the close of the review of the second edition of this book published in these columns Feb. 15, 1923, p. 310, the present writer said: "This review may seem to be unduly adversely critical, but the reviewer feels that the author made an unfortunate mistake in not bringing his book up to date, particularly in view of the great amount of research work which has rendered many data available. The volume still remains the best of its kind, but its date of issue, for most purposes, is as of 1905."

The author having used the entire second edition, with practically no revisions or correction of errors, as the first 632 pp. of his new edition, it is felt that nothing further need be said about that part of the new edition. One may read the review of the second edition or the paragraph from it just given and form an idea of the value of the greater part of the present edition. However, attention must be called to a portion of the last sentence in the above-quoted paragraph: "The volume still remains the best of its kind." This no longer holds. A thorough revision of another volume on portland cement since the appearance of the second edition of Eckel takes a position far in advance of any of Eckel's editions, although it does not cover lime and gypsum. But the portion of Eckel's work given to these commodities is now so completely out of date as hardly to justify any attention.

The author has added 44 pp. of new material devoted to the new alumina and high-early-strength cements. But one can sense that if any author has given no concern in the issuing of new editions over a period of 23 years, during which there has been marked advance in the subjects under discussion, to even minor revisions, he will hardly give adequate thought to any new material. Such is the case. The new material is totally inadequate and in no way justifies the new edition. The manufacture of these new cements and what they are is so poorly presented that it might as well have been omitted. The only data on the strength of concrete made from either the commercial high-aluminum or commercial high-early-strength portland cements are those obtained from the

advertising literature of one manufacturer of the former and one manufacturer of the latter. The only data on the durability of the high-alumina cements are stated to have been secured from the unpublished files of tests carried on by the Paris-Lyon-Mediterranée Railroad in France. As a matter of fact the same data have been used in the advertising literature of the French company making the cement used in these tests since 1922.

It is most regrettable that the author will not take the time to revise thoroughly all parts of his book. There is the prestige of the first edition, outstanding for its excellence for a decade after its appearance, which would serve as a skeleton to surround with the developments since 1905 and which should incite him to place his work back in the rank it originally occupied.

Italian Handbook for Building Contractors

REVIEWED BY A. C. JANNI
Consulting Engineer, New York City

I PREZZI DELLE COSTRUZIONI Loro Determinazione ed Analisi con Speciale Riguardo ai Fabricati. By Ing. Gino Colorio. Second edition, revised. Torino-Genova: S. Lattes & C. Paper; 5x8 in.; pp. 332; two folding plates.

This is a valuable handbook for building contractors in preparing their estimated cost for great variety of constructions. The author, who since the war has been chief engineer for the reconstruction of the zone of the Province of Trento, Italy, has had the opportunity of gathering useful first-hand information from his personal experience.

As he states, the post-war reconstruction period made the evaluation of a work exceedingly difficult for contractors to estimate, due to unsteadiness of prices in both material and labor, and also difficult for the government in paying for work done on unit price basis. The author then came to the conclusion that the best way out of these difficulties was to consider each item of work from the point of view of the time taken by labor and the amount of material employed in that particular item and without any consideration as to prices, the coefficient price to be applied in each single instance. This idea, in itself, is not altogether new; but the author has developed it with great care and diligence and carried it out in all its particulars.

For instance, in the case of a cubic meter of brick masonry, for foundation, without plaster, located 2 meters below the surface of the ground, the book gives the following data: Six hours bricklayer; 8.5 hours helper; 10 per cent office overhead and general expenses on the job, including insurance; 420 bricks; 120 kg. portland cement; 0.30 cm. sand; and for each 2 additional meters in depth, to be added: one hour helper; 10 per cent overhead expenses, etc.

The above is for brick of the dimensions 0.25x0.125x 0.06, in meters; for brick of larger dimensions the above estimate is to be reduced by 0.25 hour helper and 10 per cent office overhead for every twenty bricks less than the amount of 420 above stated. The reverse is to be done in the case of brick of smaller dimensions than the above. Taking this estimate as basis, he reaches the various estimates for the upper brick masonry, for fancy brickwork, etc.

The author suggests that the profit to the contractor be computed between 5 per cent for plain work like dirt moving and 15 per cent for work of importance; with as high as 20 per cent for especially difficult work.

The book begins by stating the rules followed, in Italy, in the measurements of the different items of a work and which are mostly conventional. Afterward, in logical sequence, it gives the estimates (in time and material) for the various kinds of works, starting from excavation and finishing with the roof.

Undoubtedly it is a work very useful to Italian architects and building contractors; engineers would find in it very little help. It would not be useful in this country except in comparative studies.

Controlling Floods by Reservoirs

THE CONTROL OF FLOODS BY RESERVOIRS — By Paul Bailey. An Appendix (Bulletin 14) to the Summary Report to the California Legislature of 1927 on the Water Resources of California and a Co-ordinated Plan for Their Development. Sacramento, Calif.: State Department of Public Works, Division of Engineering and Irrigation. Paper; 6x9 in.; pp. 300; tables and illustrations.

In reporting on six years of investigation of flood-control reservoirs in the office of the state engineer of California, the author of this bulletin has departed from the stereotyped form of reports to the legislature. He presents an original, scientific method of reservoir operation whereby a definite degree of flood control may be secured by a given reservoir without serious interference with its use for water conservation.

The author emphasizes the fact that the construction of reservoirs for domestic supply, irrigation or power has little bearing on flood control unless there is a logical scheme of operation that co-ordinates these apparently contradictory uses and takes the form of a definite and enforceable rule for reservoir operation. California is entering upon a period of large reservoir construction, he says, because of the necessity of conservation, and the combined use of reservoirs for both flood control and conservation will effect great public economies.

The report presents a seasonal analysis of California floods. Definite limits are found to the time of year and the amount of seasonal precipitation which give rise to large floods and beyond which probability of their occurrence is too remote for practical consideration. The measure of the previous seasonal precipitation used is the ratio of the actual precipitation up to any date in a season to the normal precipitation up to that same date. For convenience, this ratio is called the progressive rainfall index.

The principal elements of the analysis on any one stream are: (1) Hydrographs of years of greatest recorded flood for stream on which reservoir is located; (2) plot of all floods of record for that stream; (3) probable frequency of flood discharge; (4) relation of time of year to flood occurrence; (5) progressive rainfall index at time of flood flow; (6) relation of progressive rainfall index to flood occurrence; (7) reservoir space required to control floods; (8) relation of time of year to need of reservoir space; (9) relation of progressive rainfall index to need of reservoir space.

On the basis of this analysis a plan is developed and demonstrated whereby flood control can be co-ordinated with conservation so that the same reservoir capacity can be used for both purposes without detriment to its yield for municipal, irrigation or hydro-electric supply. This demonstration is supported by the application of the analysis to four principal rivers in California—Sacramento, Mokelumne, San Joaquin and San Gabriel. Rules for reservoir operation in order so to co-ordinate flood control and conservation are developed and then tested in their application to specific reservoirs. These tests are

carried through the entire period of recorded stream flow and are tabulated in the report. The present usefulness of the principles developed when applied to conservation reservoirs is to reduce flood discharge not more than to about half the rate of the maximum flood.

The presentation is complete in its detail and is accompanied by many analytical diagrams and tables. The author has a large corps of assistants in the study, principal among whom is A. D. Edmonston, assistant state engineer. The work has been reviewed by an engineering advisory committee of nine leading civil engineers of California.

Publications Received

RECENT WOOD UTILIZATION BULLETINS issued by the U. S. Department of Commerce on behalf of the National Committee on Wood Utilization and Seasoning, Handling and Care of Lumber and Grade Marking of Lumbering for the Consumers' Protection (15c. and 10c. respectively from Superintendent of Documents, Washington, D. C.).

ENGINEERING RESEARCH SPECIAL REPORT No. 8 of the Purchasing Department of Scientific and Industrial Research is entitled Researches on Springs and deals with the Measurement of the Displacement of Vehicle Springs Under Road Running Conditions (45c. from British Library of Information, 5 East 45th St., New York City; or 1½s. from H. M. Stationery Office, London, England).

BUILDING RESEARCH PAMPHLETS compiled under the auspices of the British Department of Scientific and Industrial Research deal with Effect of Moisture Changes on Building Materials (Bull. 3, 1s.), and Thermal Conductivities of Walls, Concrete and Plastered (Technical Paper 6, 9d.). The pamphlets may be obtained in this country from British Library of Information, 5 East 45th St., New York City, or from H. M. Stationery Office, London, England.

THREE OCTAVO PAMPHLETS have been issued for circulation among those interested in structural steel by the American Institute of Steel Construction, 285 Madison Ave., New York City: Endurance and Beauty in Steel Bridges, by Charles E. Fowler; Earthquake-Resistant Structures, by W. M. Butts; Obsolescence of Buildings, by A. T. North. Mr. Fowler's pamphlet (19 pp.) contains some historical and descriptive notes and expressions of opinion regarding a number of iron and steel bridges built during the last century and a half. Numerous illustrations are included, mostly halftones which unfortunately do not show up very well. The paper by Mr. Butts is a reprint of one presented Jan. 12, 1927, before the Los Angeles Section of the American Society of Civil Engineers and given in substance a little earlier before the California Section of the American Water Works Association. The paper on obsolescence deals with office buildings, hotels, apartment houses, tenements, commercial and industrial buildings. It appears to be based largely on an earlier paper by Earle Shultz, published by the National Association of Building Owners and Managers, Chicago.

PUBLICATION No. 72 of the Conservation Commission of Indiana (Indianapolis) is entitled "Surface Water Supply of Indiana." It gives stream-flow measurements for the period between May 23, 1922, and Dec. 30, 1927, these measurements having been initiated at the earlier date. The pamphlet (158 pp.) was compiled under the direction of Denvil Doggett, assistant state engineer. W. K. Hatt is state engineer of Indiana.

THREE BULLETINS from the Engineering Experiment Station of the University of Illinois, Urbana, Ill., are: Application of Coal, by Samuel W. Parr, professor of applied chemistry, emeritus (35c.); Thermal Expansion of Fireclay Bricks, by Albert E. R. Westman, research associate in ceramic engineering (15c.); Flow of Brine in Pipes, by Richard E. Gould, research assistant, and Marion I. Levy, graduate student, in mechanical engineering.

THE PIONEER BUILDING ORDINANCE in England, known as the Fitz-Elwyne's Assize of Building, I Richard I. (1189), has been reprinted as a supplement to the *National Municipal Review* (261 Broadway, New York City; 50c. per issue) for September, 1928. The assize provided for was a body of twelve men, chosen by the Aldermen of London, designated to act, it appears, as a sort of viewing body and possibly as a board of appeal in conjunction with the mayor to pass upon party walls, "necessary chambers" in houses (cesspools ?), roof gutters and surface drains affecting abutting property and other matters.

DELIVERY OF IRRIGATION WATER, by Wells A. Hutchins, associate irrigation economist, is a remarkably complete and valuable manual of irrigation canal practice. It deals with systems of operating laterals, analysis and comparison of the several methods of delivery (continuous, demand and rotation) and organization of ditch-riders and management, besides a large number of related details. Indirectly it suggests numerous important features of the planning of irrigation systems. Methods of measurement are not covered, unfortunately. Observations on nearly 100 irrigation projects were used in preparing it. (10c. from Superintendent of Documents, Washington, D. C.)

A SOUVENIR of the opening of the Todd River water scheme for water supply of the Todd River District, Eyre Peninsula, South Australia, may be obtained from Herbert E. Bellamy, hydraulic engineer, South Australian Department of Public Works, Adelaide. Up to the middle of 1928 some £2,500,000 had been expended out of a total to exceed £3,000,000. The district comprises some 10,000 square miles. Thus far about 500 miles of trunk and lateral water mains have been laid, out of at least double that amount for the entire project. Water is pumped to a 2,400-Imp.m.g. storage reservoir and flows by gravity through a trunk main 240 miles long composed of 21- to 16-in. lock-bar steel pipe and 16- to 10-in. cement-mortar-lined welded steel pipe of the Hume type.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

DERRUHRVERBAND—By Dr.-Ing. Karl Imhoff. Zweite Auflage, July, 1928. Berlin W. 8: Carl Heymanns. Paper; 8x12 in.; pp. 25 + 76 halftones and folding map.

Description of the Ruhr district and its sewage-works brought to date.

MANUAL OF SURVEYING FOR FIELD AND OFFICE—By Raymond E. Davis, M.S., C.E., Professor of Field Engineering, University of California. Second Edition. New York: McGraw-Hill Book Co. Flexible; 4x7 in.; pp. 401; illustrated. $3.

For college use. In this edition the chapter on field astronomy has been revised to give "civil time," reckoned from midnight. Polaris tables have been brought to date in a new form and other tables have been added. The first edition was noted in *Engineering News*, Nov. 18, 1915, p. 980.

MARINE DIESEL OIL ENGINES: A Manual of Marine Oil Engine Practice—By J. W. M. Sothern, M. Inst. of Marine Eng., Companion, Inst. Mech. E., etc., Principal Sothern's College of Marine Engineering, Glasgow. Third Edition. London: Crosby Lockwood & Son. Cloth; 6x9 in.; pp. 984; 600 line cuts and halftones. 45s. in England.

Designed as a text book for use preparatory to Board of Trade and other examinations and as a "reference work for engineers, superintendents and shipowners." Present edition "generally revised and corrected."

A PLAN FOR THE CENTRAL RIVER FRONT OF ST. LOUIS—City Plan Commission, Harland Bartholomew, Engineer. Boards; 8x11 in.; pp. 40; illustrated. $1.50 from F. E. Lawrence, Jr., Secretary, 201 Municipal Courts Building, St. Louis, Mo.

PRINCIPLES OF TRANSPORTATION—By Emory R. Johnson, Ph.D., Sc.D., Dean and Professor of Transportation and Commerce, Grover G. Huebner, Ph.D., and G. Lloyd Wilson, Ph.D., Professors of Commerce and Transportation, Wharton School of Finance and Commerce, University of Pennsylvania. [Appleton's Transportation Series.] New York: D. Appleton & Co. Cloth; 6x9 in.; pp. 815; illustrated. $5.

REINFORCED-CONCRETE BRIDGES: The Practical Design of Modern Reinforced-Concrete Bridges, Including Notes on Temperature and Shrinkage Effects—By W. L. Scott, M.Inst.C.E., Chief Engineer Considère Construction, Ltd., Assisted by C. W. J. Spicer. Second Edition, Enlarged. London: Crosby Lockwood & Son. Cloth; 6x9 in.; pp. 220; line cuts and halftones. 25s. in England.

STANDING WAVE FLUMES and Flume Meter Falls, Notes On—By C. C. Inglis, Executive Engineer, Special Irrigation Division, Public Works Department, Government of Bombay. Boards; 8x13 in.; pp. 35; tables and illustrations, including folding plates. 4½s. from Superintendent Government Printing, Bombay, India, or from High Commissioner for India, 42 Grosvenor Gardens, S.W. 1, London, England.

Descriptive and mathematical notes which promise to be of world-wide use.

VALUATION OF PUBLIC SERVICE CORPORATIONS: Legal and Economic Phases of Valuation for Rate Making and Public Purchase—By Robert H. Whitten, Ph.D. Revised and Enlarged by Delos F. Wilcox, Ph.D., Author of Municipal Franchises, etc. Second Edition. Vol. I: Physical Property—Just Compensation. Vol. II: Overheads—Intangibles—Depreciation—Rates of Return. New York: The Banks Law Publishing Co. Cloth; 6x9 in.; pp. 2081. $30.

News of the Week

Conference of State Sanitary Engineers Is Held in Chicago

Practice and Problems in Health Work Considered in Committee Reports and Discussions

ASSEMBLED at Chicago on Oct. 13-15 for its ninth annual meeting, the State Conference of Sanitary Engineers elected as chairman for 1928-29 E. S. Tisdale, Charleston, W. Va., and as vice-chairman C. G. Gillespie, Berkeley, Calif., chief engineers, respectively, of the West Virginia and California health departments. For secretary-treasurer R. E. Tarbett, sanitary engineer, U. S. Public Health Service, Washington, D. C., was chosen. Mr. Tarbett, it was announced, has recently been made bureau engineer of the service, with the field engineers reporting to him instead of to an assistant surgeon general. The membership of the conference is now 46 active, 3 affiliate and 86 associate members, the full members being chief state sanitary engineers except for one or two sanitary engineers of the Public Health Service.

Whether to hold the next meeting of the conference by itself and, if not, the preferences of the members as to what association—as A.P.H.A., A.W.W.A. or Am.Soc.C.E.—to meet with was referred to letter ballot of the members.

Progress in Sanitation

Besides two sessions each on Oct. 13 and 15, devoted almost wholly to committee reports dealing with health administrative work and problems, there was an all-day boat and bus "recreational and educational trip" on Sunday, provided by the Sanitary District of Chicago, with stops for the inspection of the district's North Side and West Side sewage-works, the former being the recently completed activated-sludge plant described on p. 543 of last week's issue, and the latter an Imhoff tank plant, now well on its way to completion, through which the sludge of the North Side plant is passed for digestion. At a dinner Saturday evening remarks on the relation of consulting to state sanitary engineers were made by Paul Hansen, Chicago, formerly engineer of the Illinois State Department of Health, and on regional engineering by W. W. De Berard, associate editor of *Engineering News-Record*.

The committee on camp and outdoor sanitation (President-Elect Tisdale, chairman) reported good progress in the extension of approved sanitary

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Diversion Tunnel Holed Through at Owyhee Dam

The 9x9-ft. headings of the 1,000-ft. diversion tunnel which will carry the waters of the Owyhee River around the dam during construction were successfully holed through on Oct. 6. The work of enlarging the tunnel to 22½ ft. circular section was immediately started, and it is expected that the concrete lining will be completed in time to pass the high water next spring. The project was described in *Engineering News-Record*, April 26, 1928, pp. 663-667.

Canadian Supreme Court to Rule on Power Ownership

The question of whether ownership of water power developed from navigable streams in Canada rests in the dominion government or in the separate provinces has been brought before the Supreme Court of the dominion in a case which is now being argued in Ottawa. The decision will have a far-reaching effect upon future negotiations for the international waterway through the St. Lawrence River, inasmuch as the potential water power in this stream alone is estimated at 4,000,000 hp. In view of the importance of the issue, it is believed that the decision of the court, when made, will be carried to the Privy Council in England for final adjudication. Meanwhile many projects for power development are being held in abeyance.

Portland Cement Association Replies to Charges

A reply to the charge of unfair practices made by the Federal Trade Commission, as reported in *Engineering News-Record*, Aug. 9, 1928, p. 223, has been filed with that body by the Portland Cement Association. The reply asserts that the Federal Trade Commission is without jurisdiction, for the reason that there has been presented no competition in interstate commerce and hence no question of fair or unfair methods. It is stated that neither the association nor the members thereof enter into paving or road-making contracts, that the only commerce involved is that of the manufacture and sale of cement and that the members of the association sell their products without discrimination to any person, firm or corporation. It is also stated that members of the association do not deal in commerce with paving contracts or road machinery and that, therefore, they nowhere compete in commerce with the American Vibrolithic Corporation, as alleged in the complaint.

American Welding Society Talks of Structural Steel

Building Construction and Steel Cutting Treated—Revision of Building Codes Needed

THREE of the ten papers presented at the fall meeting of the American Welding Society in Philadelphia, Oct. 8-12, were devoted to the general subject of welding and flame-cutting structural steel. The American Bureau of Welding, the research department of the society and also of the National Research Council, presented progress reports of four committees—fundamental investigations, pressure vessels, welded rail joints and structural steel. The structural steel welding committee in a special meeting made final arrangements for ordering steel from the mills and assigning it to fabricating shops to be made into test specimens patterned after those developed in its preliminary investigations at the University of Toronto laboratories.

Concurrent with the welding meeting were held the conventions of the American Society for Steel Treating and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, all three of which participated in and benefited by the National Metals Exposition at the Commercial Museum, where all of the afternoon technical sessions of the American Welding Society were held. Although the predominant type of equipment shown was devoted to steel treating, metallurgy and mechanical engineering, there were many exhibits of importance to the structural and welding engineer, such as electric arc welders, flame-cutting and gas-welding torches, welding wire, structural steel shapes, saws, lathes and machinery for fabricating shops.

Design of Welded Structures

The most comprehensive paper was presented by F. P. McKibben, consulting engineer, General Electric Company, on "Design of Welded Structures," a paper on which he is basing a six months' speaking tour covering the entire country. Electric arc welding has passed the experimental stage, according to Professor McKibben, who pointed to the existence of 50 welded buildings and to the fact that not one failure in any welded building has occurred. Numerous tests have provided data so that structural details can now be confidently designed for welding. Securing the recognition of structural welding in city building codes is, in the opinion

of Professor McKibben, the most important current task of the welding fraternity. Some 20 to 30 cities are now working on code revision, and the American Welding Society has a committee at work on the drafting of a master code for their use.

The remainder of Professor McKibben's paper was devoted to buildings which the General Electric Company has fabricated and erected by arc welding. These buildings are largely single-story roof truss structures. It is Professor McKibben's opinion that in this type of building new and improved designs are possible by virtue of the welding process, while in beam and column buildings welding can hardly be expected to contribute more than a limited number of new details; furthermore, greater saving in cost is possible in truss buildings than in beam and column buildings. According to Professor McKibben, there are numerous questions which need to be answered by tests. Among these are: (1) Does the stress per square inch in a fillet weld decrease with the length of the fillet? (2) Is the longitudinal shearing stress less or more if the fillet is applied in layers? (3) Is longitudinal or transverse shear resistance in a fillet weld the greater?

J. H. Edwards, chief engineer, American Bridge Company, in discussing the paper, told of a twelve-story hotel which has recently been completed at Hot Springs, Va. This is the largest tier building that has yet been completely welded. Tests of welding operators were presented by Professor McKibben which showed a variation in strength of specimens made of nearly 30 per cent between the best and the worst welder. F. T. Llewellyn, of the United States Steel Corporation and president of the American Welding Society, pointed out that such a variation is not uncommon in riveted connections. Marshall Williams, assistant general operating manager, American Bridge Company, stated that so far as shop fabrication of welded structural steel is concerned, higher rental costs militate against it. He said that it takes considerably longer to weld a 90-ft. girder than to rivet one.

Erection of Buildings by Welding

In a paper, "Erection of Buildings by Welding," by J. F. Lincoln, vice-president, Lincoln Electric Company, four reasons were given for the high cost and slow acceptance of the welding process: (1) Lack of a trained personnel; (2) lack of initiative on the part of the designers in developing designs based on the possibilities of welding and the ignoring of past riveted precedent; (3) the use of too small electrodes and current (Mr. Lincoln recommended ¼-, 5/16- and ⅜-in. electrodes with currents up to 400 amp. or higher); and (4) the lack of proper building codes which will permit welding to be used without the many compromises to which it is now subjected. Mr. Lincoln outlined the following steps which should be taken to secure the greatest advantage in welding structural steel buildings: (1) Eliminate overhead welding and reduce vertical welding; (2) place weld material according to requirements; (3) use stepped columns and continuous beams; (4) change erection methods as little as possible so that the present types of labor can successfully erect welded structures; (5) eliminate all punching of heavy pieces; (6) ship as much steel as possible direct from mill to job; (7) in erecting, have the welding follow several floors behind the bolting assembly; (8) use large electrodes and large current; (9) eliminate scarfing on all sections ½ in. or less; (10) carefully inspect finished welding and the technique of the operator; (11) do everything possible to eliminate difficulties in erection. Mr. Lincoln characterized the latter step as "the most important thing in structural steel welding" and presented about a dozen possible connections designed with the idea of expediting the erection work.

Oxy-Acetylene Cutting in Structural Field

The third paper of prime interest to the structural engineer was entitled "Oxy-Acetylene Cutting in the Structural Field," by D. E. Roberts, Linde Air Products Company. Mr. Roberts showed the results of tests on the strength of specimens cut by machining, shearing, sawing and flame-cutting with oxy-acetylene. The latter specimens showed a greater strength than any of the others. Other tests indicated that it is not necessary to mill the cut edge of a specimen flame-cut by oxy-acetylene. In discussion, James W. Owens, director of welding, Newport News Shipbuilding & Dry Dock Company, recommended the use of the gas cutting torch in making holes for welding erection purposes.

Typhoid Outbreak Caused by Defective Water Supply

Early in October a sudden outbreak of typhoid fever occurred in Olean, N. Y., which grew to alarming proportions in a very short time. Five cases were reported on the first day, increasing to fifteen over the week-end, 55 the following day and 98 the day following. A late report from E. J. Clohessy, city engineer, states that the spread of the disease has been checked at a total of 186 cases, most of which are comparatively light. Aid was rushed to the stricken town by the New York State Department of Health and the American Red Cross, which resulted in keeping the number of fatalities to a minimum.

Blame for the epidemic has been definitely placed upon the supplementary water supply of the city, which is obtained from wells in South Olean only during periods of water shortage. The main water supply is obtained from a creek and is filtered and chlorinated. The supplementary supply, however, is merely chlorinated through an automatic apparatus controlled from a distance. It was at first believed that this mechanism was defective and that the water had not received sufficient treatment, but later reports place the blame upon a leak where the suction main of the city's supplementary supply passes beneath a badly polluted stream. Investigations are being made by the city authorities and the State Department of Health which will definitely determine the cause of the epidemic. It is stated that the supplementary well water was used at intervals during June, July, August and September.

Singapore Dockyard Contract Let for $38,850,000

The British Admiralty has just awarded to the firm of Sir John Jackson, Ltd., Westminster, England, a contract for the construction of new dockyard at Singapore, Straits Settlements, at an announced price of $38,850,000. The contract is to be completed within seven years. The large floating dry dock which has recently completed a successful trip from England, as noted in *Engineering News-Record*, Aug. 9, 1928, p. 212, will be a part of this scheme, which will also include wharves, workshops, railways, roads, water-supply systems, a foundry and other up-to-date equipment required in a modern naval base. It is planned to use a large amount of native labor on the construction, although supervision will be largely in the hands of Englishmen. A provision of the contract requires that all goods used must be produced within the British Empire and that only British subjects may be employed.

Bids Called For on Kill van Kull Bridge Steelwork

The Port of New York Authority has announced that bids for the structural steel for the arch and approaches of the Kill van Kull bridge, between Bayonne, N. J., and Port Richmond, Staten Island, will be received Nov. 5. Approximately 26,000 tons of structural steel is involved in the contract, with a specified date of completion of April 1, 1931. The main arch will measure 1,675 ft. from center to center of bearings. The roadway crown at the center line of the bridge will be 163 ft. above water level. Approach spans will be about 2,000 ft. long, consisting of steel plate girders resting upon concrete piers. The structure is expected to be opened to traffic in 1932.

New Railroad Authorized in South Carolina

The Interstate Commerce Commission has granted a certificate authorizing the construction of the Atlantic & Northwestern Railroad from Mount Pleasant, S. C., northeastward to McClellanville, about 32 miles, thence northwestward about 18 miles to Jamestown, S. C., where it will connect with the Seaboard. The construction cost is estimated at $560,383. The section served by the new line has been largely dependent on water transportation, due to poor roads.

Sanitary Engineers' Conference

(Continued from p. 599)

measures at camps and in the posting of safe-water roadside signs, in accordance with recommendations of its report approved in 1927. The committee on rural plumbing and sanitation (A. H. Wieters, chairman) reported that of 44 states reporting only eight have a state plumbing code, with the code of statewide application in only four cases. The committee recommended the adoption of plumbing codes in all the states; also state rather than local licensing of plumbers. Favorable mention was made of the federal or Secretary Hoover model plumbing ordinance.

Detailed minimum requirements for the location and construction of hand-pump wells and for the design of hand-pumps, all from the sanitary viewpoint, were submitted by a committee headed by H. F. Furguson, Springfield, Ill. The committee on milk sanitation (H. A. Whittaker, chairman) submitted amendments to its report, approved and published last year. It is hoped that the amended report will be published in *Public Health Reports* (U. S. Public Health Service).

To Review Cross-Connections

At the suggestion of A. D. Weston, president, New England Water Works Association, the conference voted to create a committee to review the cross-connection elimination situation, with a view to possible changes in the resolutions for elimination adopted by the conference two or three years ago, which are similar to those adopted by the American Water Works Association. Mr. Weston cited the inability of the New England Water Works Association committee to agree on the subject, in view of the feeling of some of the members that municipalities have a responsibility to manufacturers in this matter. Discussion brought out the fact that there are now at least four makes of double check valves of approved type.

Financing sewage-disposal systems, the technical supervision of such works and also sewage research were dealt with in the report of the committee on sewage treatment (F. H. Waring, Columbus, Ohio, chairman). Under the Ohio sewer rental act of 1923 seventeen municipalities, with populations of from 600 to 150,000, have decided to finance their sewerage and sewage-disposal operations wholly or in part by the collection of sewer rentals. There seems to be a trend toward the same plan in other states as to technical supervision. There are in Ohio eight large cities with full-time technically trained men in charge or about to take charge of sewage-works; five smaller places with such men who divide their time between the sewage-works and the service for the city, and seventeen small places with technical supervisors from large cities. Where there is technical supervision from without, it appears that it should be by "a man actively engaged in sewage-treatment plant operation rather than from consulting staffs or other technical sources." The committee reported favorably on research work, conferences of sewage-works operators and short schools for these men, citing New Jersey and Texas as affording leading examples of all three.

Approval was given to proposals by the committee on water purification and treatment (H. W. Streeter, U.S.P.H.S., Cincinnati, chairman) to make a census of water-filtration plants, as of 1930, thus bringing to date the 1925 census by C. A. Gillespie, and also to make a detailed study of the efficiency of chlorination, especially in connection with filtration. The discussion brought out the fact that a questionnaire on water purification, more elaborate than the proposed census, has been prepared by a committee of the water purification division of the A.W.W.A. (James W. Armstrong, Baltimore, chairman). An extended discussion followed a brief progress report by the committee on sanitation of real estate divisions (L. F. Warwick, Madison, Wis., chairman). No unanimity of practice was shown, due in part to diversity of the organization and powers of minor civil divisions in the various states. F. H. Waring cited the Ohio county sanitary district law as a satisfactory means of providing water supply and sewerage in territory outside the large cities. H. E. Miller said that in North Carolina a law is operative that permits the formation of sanitary districts regardless of county lines.

Lackawanna to Use Direct Current

Preliminary plans announced by the Delaware, Lackawanna & Western for its proposed electrification of suburban service include the use of 3,000-volt direct current delivered by the overhead catenary system to multiple-unit cars. This system was adopted, as it seems best suited to meet the operating requirements of both suburban and main-line service, in the event that it is later considered advisable to extend the electrification west to Scranton, Pa., 134 miles from Hoboken. No definite decision has been reached upon the problem of whether to build power plants or to purchase power, but it is practically certain that part, at least, of the required current will be generated in the road's own stations to insure against power failure. Mercury-arc rectifiers will be used in connection with the application of the power to trains.

Am.Soc.C.E. Increases Number of Honorary Memberships

An amendment to the constitution of the American Society of Civil Engineers recently adopted increases the permissible number of honorary members from an arbitrary limit of twenty to a fixed ratio of one honorary member for every unit of 300 in the membership of the society. With the present enrollment this proportion will permit a total of about 40 honorary members.

Street Sanitarians Meet at Toronto

With over 150 in attendance from Canada, the United States and Cuba, the International Association of Street Sanitation Officials met at Toronto, Ont., Oct. 8 and 9 for its ninth annual convention. In his brief opening address President Theodore Eichhorn, superintendent of streets and public improvements, Erie, Pa., stated that 76 members had been added to the association during the year.

Robert B. Brooks, director of streets and sewers, St. Louis, Mo., was elected president for 1928-29, and A. M. Anderson, 10 South La Salle St., Chicago, was re-elected secretary. The next meeting place was tentatively fixed as Jacksonville, Fla. On request of the Public Administration Service, New York City, a committee of five to co-operate with the National Committee on Municipal Standards was authorized.

Budget making, as exemplified by a city now on the point of allotting to its street-cleaning department $27,000,000 out of $530,000,000 for the 1929 budget, was described by Elmer C. Goodman, examining engineer, Department of Street Cleaning, New York City.

In a paper on garbage fermentation, Arthur Boniface, village engineer, Scarsdale, N. Y., passed lightly over the failure and abandonment of the Beccari plant built a few years ago after the Italian models and outlined a second fermentation plant, designed on different lines, and utilizing, he said, first anaerobic then aerobic action. He characterized the new plant as decided a success as the old one was a failure. Construction cost he put at $2,000 per 1,000 population, or $2,500 with reserve cells. He did not advise the process for other than villages and small cities, especially of high-grade residential character, with disposal in or near residence sections.

New York Awards Two More Subway Contracts

In addition to the two subway contract awards noted in last week's issue totaling over $12,000,000, the New York City Board of Estimate has approved two additional contracts for extensions to the city subway system. The Cornell Contracting Company will build a section of the Smith-Ninth St. line in Brooklyn extending from Prospect Park to Terrace Place for $3,145,000, and the Larocca Construction Company a section of the new Bronx subway for $6,490,000. Both firms were low bidders.

Builder and Architect Honored

At the recent dedication of the $25,000,000 medical center of Columbia University, New York City, the degree of Doctor of Science was awarded to Otto Marc Eidlitz, contractor, and James Gamble Rogers, architect.

Railway Roadmasters Hold Big Annual Meeting

Engineers and engineering practice were prominent in the proceedings of the annual convention of the Roadmasters and Maintenance of Way Association, held at Detroit, Mich., in September, with an attendance of more than 400 members and visitors. Committee reports included: "Care of Winter-Laid Rails," M. J. Nugent, assistant engineer, Delaware & Hudson Railroad; "Programming Section Work," J. J. Desmond, roadmaster, Illinois Central Railroad; "Distribution of Material," R. H. Smith, superintendent, Norfolk & Western Railway; "Preventing Damage to Rail Ends," C. F. Allen, division engineer, Chicago, Milwaukee, St. Paul & Pacific Railway; and "Organization of Track Forces," A. A. Johnson, track engineer, Delaware, Lackawanna & Western Railroad.

Individual papers included: "Essentials of High-Speed Track," by J. F. Deimling, chief engineer, Michigan Central Railroad; "Manufacture and Service of Rails," by C. B. Bronson, assistant inspecting engineer, New York Central Lines; and "Permanent Track Construction," by Paul Chipman, valuation engineer, Pere Marquette Railroad.

Officers for 1928-29 include: President, H. R. Clarke, general inspector of maintenance-of-way, Chicago, Burlington & Quincy Railroad; secretary, T. F. Donahoe, general supervisor of road, Baltimore & Ohio Railroad, Pittsburgh, Pa.

The next annual meeting will be held at Chicago in September, 1929.

New Jersey Board of Health Acts on Cross-Connections

Addition by the New Jersey Department of Health of a new chapter to its state sanitary code on Sept. 18 prohibits making physical connections, including cross-connections, between approved and unapproved water supplies after April 1, 1929, but makes possible temporary permits for a continuation of cross-connections then existing, provided they are protected by a stipulated type of double check valves and the application for extension is approved by both the local and the state boards of health.

Action in this matter was first taken on Oct. 6, 1925, in the form of a resolution, instead of by addition to the sanitary code, and was absolutely prohibitive effective Jan. 4, 1926. On March 2, 1926, this resolution was amended to become effective Jan. 1, 1928, but the postponement applied only to cross-connections guarded by two check valves of the Factory Mutual type. Meanwhile, in line with general recommendations of the Conference of State Sanitary Engineers and the American Water Works Association, H. P. Croft, chief of the bureau of engineering, submitted an amendment to the state sanitary code, prohibiting not only cross-connections but various other physical connections between approved and unapproved sources of water supply. Opposition having arisen, action on the proposed new chapter was deferred from time to time until Sept. 18, when a substitute chapter was adopted, as follows:

CERTAIN PHYSICAL CONNECTIONS UPON PUBLIC POTABLE WATER SUPPLIES PROHIBITED

Enacted by the New Jersey State Department of Health, Sept. 18, 1928, as Chap. XIII of the State Sanitary Code.

1. A physical connection shall be considered as any cross-connection, bypass, valve, pipe line, auxiliary intake, or other similar device which permits or may permit any flow of water into an approved public potable water supply from any other water supply unapproved by the Department of Health of the State of New Jersey, or any source of water supply not fully treated in accordance with the terms of the provisions of the permit issued for or the rules and regulations governing the supplying of such water for public potable purposes by the Department of Health of the State of New Jersey.

2. That after April 1, 1929, physical connections shall not be permitted, except where such physical connections existing on April 1, 1929, include two all-bronze check valves with rounded rubber facing, two gate valves with indicator posts or rising stems and drip cocks and gages for testing, and such physical connection is located in a vault or pit of watertight construction readily accessible for inspection; and,

Provided that application for the continuation of such a physical connection is made to the local board of health having jurisdiction and is approved by such local board of health, the date of continuance may be temporarily extended by the Department of Health of the State of New Jersey.

The words "special Factory Mutual Fire Insurance design, or equivalent," applying to the double check valves, appeared in the added chapter of the code, as originally presented, but are omitted from the chapter adopted Sept. 18, but there has been inserted a requirement for "two all-bronze check valves with rounded rubber facing," apparently having in mind these features of the "improved" Factory Mutual design. (See *Engineering News-Record*, Aug. 25, 1927, for more detailed review of earlier action in this matter.)

California Sewage Works Body to Hold First Annual Meet

The California Sewage Works Association held its first annual meeting at San Bernardino, Calif., Oct. 9 to 12, inclusive, in conjunction with the annual meeting of the League of California Municipalities. Two days were devoted to technical papers and discussions and two days to inspection and demonstrations.

The papers included the following: "Standardizing Sewer Pipe," by E. L. Phillips, assistant engineer, sewer division, city of Los Angeles; "Watertight Sewer Joints," by H. P. Cortelyou, construction engineer, engineering department, city of Los Angeles; "Methods of Sewer Cleaning," by F. A. Batty, maintenance engineer, engineering department, city of Los Angeles; "Report of Committee on Trade Waste and Sewage Disposal," by W. T. Knowlton, metropolitan sewer division engineer, engineering department, city of Los Angeles; "Financing of Sewer Maintenance," by Leon B. Reynolds, professor of hydraulic and sanitary engineering, Stanford University; "Know Your Sewage," by Clyde C. Kennedy, consulting engineer, San Francisco; "Sludge Digestion," by C. G. Gillespie, chief, bureau of sanitary engineering, State Department of Public Health; "Trials and Tribulations of Sewage-Works Operators," by A. M. Wyman, superintendent, Pasadena sewage-disposal plant; "Odor Control by Chlorination," by R. F. Goudey, resident engineer, Los Angeles, State Department of Public Health.

Concrete Reinforcing Steel Institute Meets

The semi-annual meeting of the Concrete Reinforcing Steel Institute was held at Shawnee-on-Delaware, Pa., Oct. 1-3. Reports were presented by a number of committees, and papers of interest to the engineering profession were heard. By co-operation with the U. S. Department of Commerce, a new recommendation was adopted for standardized form dimensions, this to be subject to the usual referendum of the department. The approved dimensions are as shown in the following table:

Widths of Standard Forms, In.	Depths,* In.
20	6,8,10,12,14
30	6,8,10,12,14

Widths of special filler forms to be 10 and 15 or 12 and 16 in. only.

*Depth is the vertical distance from the under side of the concrete slab above the center of the form to the bottom of the concrete joist.

The directors of the institute approved the report of the committee on engineering, selling and carting costs, which provides that, starting Jan. 1, 1929, the institute shall compile monthly reports from its members on the following: (1) Cartage costs for the entire country, New York and Chicago to be shown separately; (2) engineering costs, including estimating, engineering and overhead; (3) selling costs, inclusive of all related activities, overhead and administration. The cost-keeping system will be made as simple as possible. The directors were convinced that low quotations would not be made by certain fabricators if they had real knowledge of their costs.

Papers were presented as follows: "Control of Selling Costs," by Walter C. Conger, Truscon Steel Company, and "A History of Building Codes," by Frank Burton, former city building commissioner, Detroit. An illustrated symposium was held on unusual construction jobs.

WASHINGTON NOTES

By Paul Wooton
Washington Correspondent

Contract for Mississippi Lock Let—Zoning Case to Supreme Court—Inland Waterways Budget

THE award of a $1,695,813 contract to the Fegles Construction Company, of Olis, Minn., for the construction of a navigation lock and dam on the Mississippi at Hastings, Minn., has been approved by the office of the Chief of Engineers. The next lowest bidder was the Northern States Contracting Company, of St. Paul, with $1,744,040. Both of these bids are lower than the government's estimate of $2,139,180 for the work. The army engineers attach significance to the fact that the eight bids on the project ranged themselves into two distinct price groups which, it is explained, coincide almost entirely with the geographical locations of the various contractors. It is pointed out that the cost of moving heavy floating equipment to the location is a considerable factor in the estimates of the contractors from other sections. There is a range of price of $900,000 between the lowest and the highest bid.

The construction of this lock and dam is in connection with the present project calling for a 6-ft. depth in the upper Mississippi to the Twin Cities. Since there is agitation to provide for a 9-ft. depth, the plans for the project have been altered so that adoption of the deeper channel will not necessitate reconstruction.

Supreme Court to Review Zoning Case

The Supreme Court of the United States on Oct. 15 consented to review a case involving the zoning ordinance in New Orleans. Leon Sampere brought suit in Louisiana attacking the constitutionality of the ordinance in restricting business establishments and in requiring buildings to be set back a specified distance from the street. He contends that this is discrimination, in that it does not apply to buildings already in existence.

Inland Waterways

As only a small percentage of the wheat offered the Inland Waterways Corporation could be accepted this year because of lack of equipment, the demand from shippers for more barges and towboats has become more insistent than ever. It is expected that the budget which goes to Congress in December will carry an estimate for new equipment, but it is practically certain that the amount will not be as large as the interests concerned are demanding. Items entering into the budget and recommendations of amounts to be carried in the budget are not made public in advance of its receipt by Congress. It is understood, however, that a resolution submitted to the advisory board of the Inland Waterways Corporation called for the appropriation of $8,000,000 of the $10,000,000 authorized in the Denison act. A majority of the board did not approve of the purchase of that amount of equipment and it is believed that the recommendation that finally went to the Secretary of War called for $5,000,000. It is believed that this amount is further pared in his recommendation to the Director of the Budget. Secretary Davis promises that public hearings will be held to determine the character of equipment that will be purchased with whatever amount may be finally appropriated.

To require the railroads to establish joint barge and rail rates with no opportunity to protest against them until after they had been put into effect was characterized by Alfred P. Thom, representing the Association of Railway Executives, as a delegating of legislative authority prohibited by the Constitution. This was his main point in presenting the railroad's side of the case at a hearing Oct. 12 before the Interstate Commerce Commission, which had before it the application of the Inland Waterways Association for a certificate of convenience and necessity covering through rates and rates on practically every railroad in the United States. Representative Denison, of Illinois, the author of the barge line act, testified that service cannot survive on a port-to-port basis. The only way to make the venture profitable and to bring its benefits to the maximum possible number of the people is to have the Interstate Commerce Commission direct the railroads to extend these arrangements to the water carriers. The rail carriers, he said, retained their rights to due process of law in objecting to any unreasonable rates that may be established. Counsel for the Mississippi Valley Association said that only 15 per cent of the through routing that should be in effect has been granted voluntarily by the railroads. On behalf of that association it also was intended that the provision of the Denison act is not a delegation of legislative authority in the purview of the Constitution. He cited instances where the Supreme Court has upheld similar laws.

Engineering Societies

CALENDAR

Annual Meetings

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Louis, Mo.; annual convention, Detroit, Mich., Oct. 22-28.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION, Chicago, Ill.; annual convention, Boston, Mass., Oct. 23-25.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Springfield, Ill.; annual meeting, Chicago, Ill., Nov. 12-15.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, New York, N. Y.; annual convention, Biloxi-Gulfport, Miss., Nov. 13-17.

Personal Notes

George C. Habermeyer, chief engineer of the Illinois State Water Survey, has resigned.

Capt. Frank B. Hastie, Corps of Engineers, recently on leave at Virginia Beach, Va., has resigned from the army and his resignation has been accepted by the President.

J. H. Gandolfo has been appointed assistant director, division of architecture and construction, State of New Jersey, with headquarters in Trenton. For 2½ years he has had charge of building the North Jersey Training School, at Totowa, N. J., for the department of institutions and agencies.

C. Douglass Buck, who has been chief engineer of the Delaware State Highway Department for nearly seven years, has been nominated for Governor of that state.

Frederick H. Andrews is resident engineer for the J. G. White Engineering Corporation on the new bridge across the Missouri River connecting Independence and Liberty, Mo.

Obituary

Edward V. Johnston, formerly inspecting engineer of the Department of Railways and Canals, Ottawa, Ont., died in Ottawa on Oct. 5, at the age of 84 years. Mr. Johnston retired from the Department of Railways and Canals in 1921 after a service of 56 years. He was one of the original charter members of the Canadian Society of Civil Engineers, which is now known as the Engineering Institute of Canada. For two years he was a member of the council of this body.

W. H. Witt, structural engineer, of Seattle, was killed Oct. 3 in a grade crossing accident near Tacoma. Following his graduation from the University of Wisconsin in 1910 Mr. Witt moved to the Northwest, where he was associated with John L. Hall, the Truscon Steel Company and Henry Bittman, Seattle architect and engineer. In 1922 he opened his own office in Seattle. He was 42 years of age.

John P. Schermerhorn, for 33 years active in various departments of the city of New York, died recently at the age of 78. He had been retired for the past thirteen years. Mr. Schermerhorn was a graduate of Rensselaer Polytechnic Institute.

John S. McCrossen, assistant engineer for the Great Northern Railroad, was instantly killed Oct. 5 while on an inspection trip through the new Cascade tunnel, when a large rock fell from the roof.

Construction Equipment and Materials

Concrete Paving Awards

The table below, prepared by the Portland Cement Association, summarizes the contracts let during September and during the calendar year up to Sept. 29 for concrete paving work in the classifications listed:

	Sq.Yd. Awarded	
	During September	Jan. 1 to Sept. 29
Roads.....	9,630,400	79,296,619
Streets.....	4,777,210	42,222,887
Alleys.....	344,810	2,980,518
Totals...	14,752,420	124,500,024

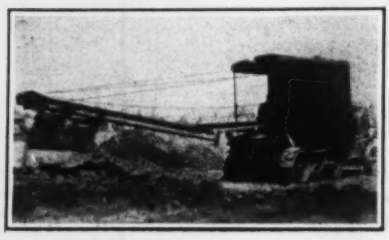
Gypsum Industry Organized

In an effort to secure co-operation among the members of the gypsum industry, a number of manufacturers have formed the Gypsum Institute, an organization which will take over the properties of Gypsum Industries, Inc., which suspended activities on May 1, 1928. The new organization will function in much the same manner as the old association and has already opened a headquarters office in New York City. Meetings will be held each month, and it is hoped that within a relatively short time progress will be made toward improving present conditions. James Leenhouts, vice-president and general manager of the Grand Rapids Plaster Company, Grand Rapids, Mich., is president of the Institute, and W. J. Fitzgerald is secretary and treasurer.

New Developments

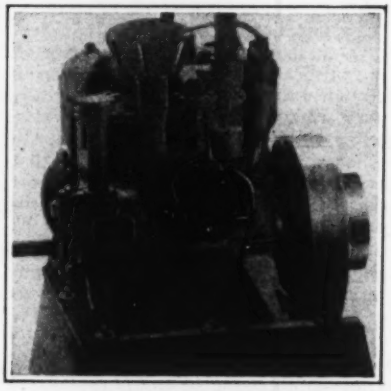
Skimmer Scoop for Truck Crane

In addition to its other excavating attachments, such as clamshells, draglines and back-diggers, the Universal Crane Company, Cleveland, Ohio, has now added a skimmer scoop to its line of truck cranes. The boom is an all-steel box section with a double track along the bottom side on which the skimmer bucket is carried by four rollers. The cutting stroke of the bucket is approximately 12 ft. By means of a boom control it is claimed that cuts can be accurately made from 6 in. to 2 ft. deep. The bucket is of a bottom-dump type. It is returned to a digging position by gravity, a special spring-mounted stop being provided at the back end of the runway to absorb the impact. To aid in the constant boom derricking required for skimmer scoop work, a special oiling device is provided for the boom feet sockets. There are only two hand levers and two foot pedals to control all major operations.



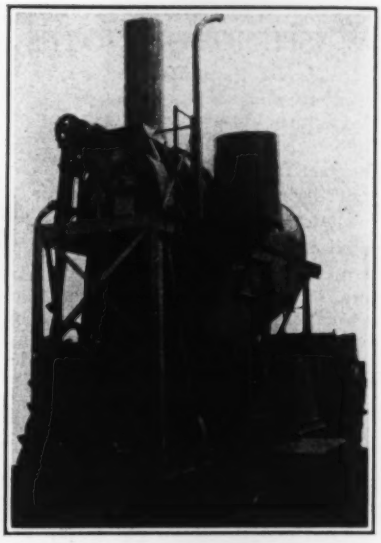
New Magneto for Small Motors

A high-tension magneto designed for use on modern high-speed one- and two-cylinder engines has just been produced by the Wico Electric Company, Springfield, Mass. It is known as Type B. The unit is oilproof, waterproof and moisture proof, and is self-lubricating. A hot spark is produced independent of the speed of the engine without the use of impulse couplings. The magneto is furnished with both miniature and standard S.A.E. mountings.



Portable Asphalt Mixing Plant

A complete, self-contained asphalt paving plant, spring mounted on rubber-tired wheels for easy transportation, is being produced by the Madsen Iron Works, Huntington Park, Los Angeles, Calif. It is intended for use in patching, resurfacing and general maintenance of asphalt roadways, and also for small surface paving jobs. The plant is designed to deliver 60 to 75 tons per eight-hour day of regular specification mix in 500-lb. batches, using a one-minute mix schedule. The production machinery comprises a bucket and belt elevator with receiving boot and head-shaft hopper and chute, a 32 in. diameter by 10 ft. rotary drier, a tapered rotary screen, a four-compartment stone and sand bin with quadruple bin gate, a 500-lb. capacity steel weigh box, mounted upon hardened steel knife-edged beams registering upon a Chatillon dial scale, and a 500-lb. capacity two-spindle pug mill mixer with renewable bottom and paddles.

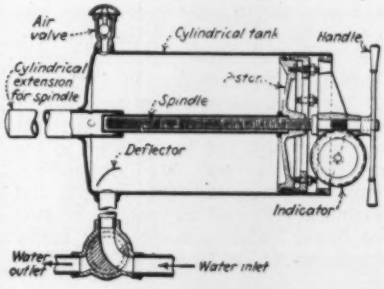


Asphalt-handling equipment consists of a 350-gal. steam-heated tank with a special melting turret for handling barreled asphalt, a cylindrical weigh bucket with scale and a distributing fan chute. Barreled asphalt is handled by a davit and power winch. An Allen steam generator unit, using oil fuel, provides low-pressure steam for asphalt heating and also operates the drier oil burner. The plant is designed for one-man operation. When desired, a U-shaped firebox and flue assembly for heating by external oil fire can be slipped up under the asphalt storage tank and bolted fast.

Power is provided by a 30-hp. Hercules gasoline engine equipped with fuel tank and radiator. Two 150-gal. electrically welded tanks are provided for oil fuel and water.

Water-Measuring Device for Concrete Mixer

A new water-measuring tank for concrete proportioning, quite extensively used in Europe, according to Adolph Baudistel, 45 West 34th St., New York City, who is introducing it in this country, is illustrated by the accompanying drawing. The apparatus consists of a cylindrical tank which can be varied in volume by adjustment of a piston or spindle. On the outer end of the spindle is a handle geared to an indicator showing the volume of the tank. Turning the handle adjusts the capacity of the



tank. On the opposite side of the tank there is an air valve at the top and a water valve at the bottom. The water valve is a three-way valve serving both as an inlet and as an outlet. The deflector shown in the illustration turns the entering water so that complete filling of the tank is assured. It is claimed that this measuring device can be fixed to any standard concrete mixer.

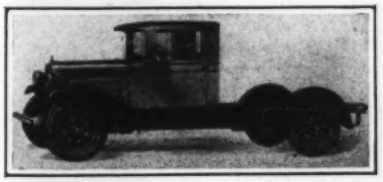
Watertight Rubber Joints for Concrete Pipe

A jointing material of the cross-section shown in the accompanying illustration and made of india rubber has been developed by a French engineer, Leon Bille, 45 Grande-Rue, Nogent-sur-Marne (Seine), France. It will be noted from the accompanying illustration that when in the installed position the water pressure against the joint tends to tighten it against the walls of the pipe. The joint is claimed to be watertight both with and without pressure. In addition, it affords the pipe line a considerable amount of flexibility

without developing leaks. M. Bille points out that the pipe can be laid under water without difficulty. Under all sorts of laying conditions, the pipe is installed by merely pushing one pipe into the other. The outside of the joint can be filled with asphalt or concrete and if necessary a concrete collar can be poured around the joints. Although primarily designed for use with concrete pipe, it is claimed that this joint is also adaptable to cast-iron, steel or wood pipe.

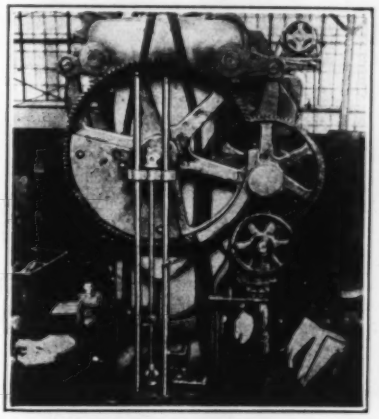
New Model 1-Ton Truck

An addition to the line of motor trucks manufactured by the Indiana Truck Company, Marion, Ind., is the new 1-ton model known as the Indiana Ranger. This is equipped with a six-cylinder, valve-in-head engine, develop-



ing 45 hp. The truck chassis is equipped with mechanical four-wheel brakes of the internal expanding type, and has a wheelbase of 137 in. Electric starting and lighting equipment, an air cleaner and an oil filter are included in the items of standard equipment. A special feature of the truck is the mounting of radiator, hood, cowl and cab as a single unit independent of the chassis as a protection from torsional strains and vibration.

A MODERN EXAMPLE OF CENTRALIZED LUBRICATION



This large sheet steel press has 40 high-pressure lubricating tubes terminating at a central and convenient location for the oiler. The machine is completely lubricated in from ten to fifteen minutes, as against a former time of 1½ hours when separate grease cups were used. Better and more frequent lubrication is also assured. The Dot Lubrication Division of the Carr Fastener Company, Cambridge, Mass., whose system was used on this press, reports that a number of construction equipment manufacturers are applying similar systems to their machines, some experimentally and some as part of a new and permanent policy of lubrication.

Business Notes

UNION CHAIN & MANUFACTURING COMPANY, Sandusky, Ohio, announces that, subject to the approval of its stockholders, it has acquired control of the American High Speed Chain Company, Indianapolis, Ind. The facilities of the two companies will be combined at Sandusky.

UTICA STRUCTURAL STEEL CORPORATION, Utica, N. Y., has appointed William F. Helmer, formerly chief engineer of the F. L. Hughes Company, Rochester, N. Y., to the post of general manager.

WALTER A. ZELNICKER SUPPLY COMPANY, St. Louis, Mo., has appointed Spencer S. Swasey, of Chicago, manager of its equipment department. Mr. Swasey has had experience with the George D. Whitcomb Company and as a contractor.

PARADON MANUFACTURING COMPANY, Arlington, N. J., has appointed F. W. DuBois, of the American Pump & Supply Company, Detroit, Mich., sales representative for Paradon chlorinators in the State of Michigan.

TRACKSON COMPANY, Milwaukee, Wis., has appointed a number of new distributors as follows: B. Hayman Company, Inc., Los Angeles, Calif.; O. R. Peterson Company, Inc., San Francisco, Calif.; Polson Implement Company, Seattle, Wash.; Zimmerman-Wells-Brown Company, Portland, Ore.; Dealers Equipment & Implement Company, Memphis, Tenn.; Evans Implement Company, Atlanta, Ga.; F-D Equipment Company, Dallas, Tex.; Industrial Tractor & Equipment Corporation, Richmond, Va.; Industrial Machinery Company, Kansas City, Mo.; and Southern Equipment Company, New Orleans, La.

ATLAS CONVEYOR COMPANY, INC., Philadelphia, Pa., announces that A. J. Forschner, who joined the company in July as vice-president, has also taken over the duties of secretary for the company.

New Publications

Acetylene Floodlights — OXWELD ACETYLENE COMPANY, New York, N. Y., describes all models of the Carbic light and gives a large amount of photographs showing the application of floodlighting to night work in a recent booklet.

Material - Handling Equipment — LEWIS-SHEPPARD COMPANY, Boston, Mass., has issued a new catalog describing its line of lift trucks, portable elevators, platforms and racks, hand trucks, carts and barrows.

Concrete Pipe Machinery — McCRACKEN MACHINERY COMPANY, Sioux City, Iowa, describes the McCracken process of manufacturing concrete pipe in a 36-page illustrated book, a large part of which is devoted to the results obtained in various parts of the world by users of the process.

Valves and Drains—JOSAM MANUFACTURING COMPANY, Cleveland, Ohio, has issued catalog G, a 72-page booklet describing the complete Josam line of drains, traps, interceptors, check valves, shock absorbers and swimming pool equipment.

Rock Crushing Equipment—AUSTIN MANUFACTURING COMPANY, Chicago, Ill., gives full details about the Austin line of rock crushers and auxiliary machinery, including screens, hoists, overhead travelers, dump cars and similar equipment, in a 48-page catalog, No. 131.

Precast Concrete Slabs — PORETE MANUFACTURING COMPANY, Newark, N. J., gives a full description of its product, Porete, in a 24-page illustrated catalog No. 27. Porete is portland cement concrete uniformly honeycombed with air cells. The catalog gives installation data, strength tests, construction details, designing data and specifications for the use of the material in roof and floors. A separate circular, No. 32, describes the Porete ribbed steel roof and floor construction.

The Business Side of Construction

General Manufacturing at Record High Level

Reports received by the *Electrical World* on the consumption of electrical energy by some 3,600 manufacturing plants scattered throughout the nation and in various industries indicate that the third quarter of the year closed with the rate of general manufacturing production at record high level. September operations, after corrections are made for the number of working days, were 11.4 per cent over August, 13.5 per cent over September of last year and 5.4 per cent above the previous high record of productivity recorded last February. That the total volume of production for the full year 1928 will exceed that of last year by several per cent is indicated by the fact that the average operations in the manufacturing plants of the nation during the first nine months of the year were 5.3 per cent above those during the same period last year. This is about 2 per cent higher than the generally accepted normal rate of annual growth in American general productive activities.

All of the national primary manufacturing groups, with the exception of lumber and its products and the textiles industry, closed the third quarter with a rate of operations over that of last year. The automobile industry, including the manufacture of repair and replacement parts, led all the manufacturing groups with a gain of 47 per cent over September of last year, followed by the ferrous and non-ferrous metal-working plants with a gain of 37.2 per cent, rubber and its products 32.2 per cent, rolling mills and steel plants 28.8 per cent, stone, clay and glass 28.7 per cent, food and kindred products 11.4 per cent, chemicals and allied products 7.7 per cent, paper and pulp 7.6 per cent and leather and its products with a gain of 1 per cent. The textile plants of the nation taken as a whole increased their rate of operations by 15.7 per cent during September over August, but were still operating at a rate 7.2 per cent under last year.

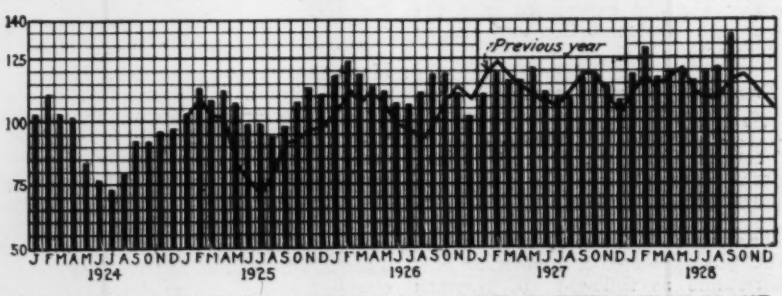
Operations in the lumber and its products group, as indicated by the consumption of electrical energy, has been under that of the corresponding month last year ever since March, although in some branches of the industry the productive operations have exceeded those of last year. Although the rate of lumber output has shown no marked fluctuations during the past three months and is quite markedly less than a year ago, lumber prices have weakened slightly during the past month. For the first nine months of the current year Southern pine and Douglas fir production showed slight declines from the same time last year, while California white pine showed a gain of 15 per cent over last year. The production of oak flooring since the opening of the year has exceeded that during the same period last year by approximately 14 per cent.

The large gains in general manufacturing activity have not been confined to any one section but have been general throughout the nation, with the exception of the Southern states. September manufacturing operations in New England were 1.2 per cent over September, 1927, notwithstanding the comparatively low rate of operations being witnessed by the textile plants of the section. Manufacturing plants in the Middle Atlantic states were operating at a rate 14.5 per cent above last year, and the North Central states headed the list with a gain of 28.5 per cent, due very largely to the record production being recorded by the automobile manufacturing industry. The Western states reported operations 6 per cent over last year, but the manufacturing plants in the South were operating on a plane about 6.7 per cent under September of last year.

There now appears to be every indication that the year 1928 taken as a whole will record high marks in production in practically every line except textiles and lumber. The operations of commerce and industry should continue on their present comparatively high plane at least until the close of the year.

E. N.-R. Index Numbers

Cost		Volume	
Oct. 1, 1928	**207.71**	**September, 1928**	**296**
Sept. 1, 1928	207.29	August, 1928	306
Oct. 1, 1927	204.40	September, 1927	273
Average, 1927	206.24	Average, 1927	263
Average, 1926	208.03	Average, 1926	228
1913	100.00	1913	100


140
125
100
75
50
Previous year
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1924
1925
1926
1927
1928

INDUSTRIAL OPERATIONS CONTINUE ON A COMPARATIVELY HIGH PLANE

Slight Decrease in New Capital Requirements

The first nine months of the year witnessed a slight decrease in the amount of new capital needed by American corporations for expansion purposes. The sale of bonds, notes and stocks for new capital purposes totaled $3,775,563,604 for the nine-month period ended Sept. 30, as against $3,809,762,119 during the same period last year, according to tabulations issued by the *Financial Chronicle*. Groups borrowing largely for new construction purposes, however, appear to have increased their new capital needs over last year. Manufacturing companies have increased their borrowings this year by about $75,000,000, and the money loaned to the group "land and buildings" totaled about $50,000,000 over the same perriod last year.

RECENT NEW CAPITAL LOANS

Company	Issue	Yield
Kentwood Apartments, Chicago	$430,000	5.8
Madison Avenue Building, New York	1,900,000	6.26
Morewood Gardens, Inc., Pittsburgh	1,200,000	6.0
Professional Building, Waco, Tex.	325,000	6.5
Rochester (N. Y), Mercantile Properties	325,000	6.0
St. Joseph R. C. Church, Baton Rouge, La.	300,000	5.0
Hartsville Paint & Dye Works, Hartsville, S. C.	300,000	6.5
Pacific Coast Terminals, Ltd., Vancouver	1,500,000	6.7
Amere Construction Company, Pittsburgh	230,000	5.5
Purcell High School, Cincinnati	325,000	5.0
Irving Cobb Hotel, Paducah, Ky.	400,000	6.0

Material Increase in Building Construction

The week ended Oct. 16 witnessed a material increase in the volume of contracts let for both commercial and industrial buildings, which also raised the total volume of contracts awarded to a point 51 per cent over the same week last year. The gain in industrial buildings was due largely to two projects—an airplane manufacturing plant valued at $3,000,000 and a rayon manufacturing plant valued at $10,000,000. The gains recorded in commercial buildings was due to projects for several large apartment houses, six of which were considerably over a million dollars in value, and one of fifteen stories was for $4,500,000. The accumulated value of all construction for the current year so far is about 15.7 per cent over the same period last year.

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week ended Oct. 16, with some comparisons, total as follows:

(In Thousands of Dollars, 000 Omitted)

	Oct. 16, 1928	Oct. 9, 1928	Oct. 18, 1927
Buildings:			
Industrial	$17,390	$2,674	$4,793
Commercial	35,639	21,007	17,146
Streets and roads	7,491	10,329	12,502
Other construction	28,852	49,227	24,702
Total	$89,372	$83,237	$59,143
Total, all classes, Jan. 1 to Oct. 16:			
1928			$2,942,647
1927			2,543,326